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Vol. 22 (Second Series) MARCH, 1945. No. 1.

Britain's Grim Food Ordeal.

SIX WINTERS OF RATIONING.

W. BANKES AMERY, Leader of the United Kingdom Food Mission to Australia and New Zealand.

During my recent short visit to England I found that the British people, who have now endured six winters of rationing, punctuated by blitz and blackout, are now eagerly awaiting what they hope will be an improvement in their ration scales as soon as the defeat of Germany has been accomplished.

SO far, however, from there being any immediate prospect of an increase in any of the major rations, it is still difficult to maintain the existing rations, particularly those for meat and butter. The rapid sweep of the conquering navies, armies, and air forces of the United Nations has brought its own special difficulties in the maintenance of feeding dumps in many parts of the world from which the troops in advanced areas can be supplied. Moreover, the fact that millions of men are in active combat and millions more are engaged in the production of munitions means that there is a severe shortage of manpower for agriculture in all parts of the United Nations. This has led to a world decline in production of most agricultural products concurrently with an increased demand.

INTERNATIONAL FOOD ORGANISATION.

It has therefore been necessary to form two international bodies, one known as the Combined Food Board, which sits in Washington, and the other as the London Food Council, which meets in London in order to attempt some apportionment of world food supplies in relation to world food needs. The problems to be faced by these bodies during the year 1945—and they will certainly be continued into 1946—are very formidable. For nearly all food products the existing world demand, without counting civilian requirements of countries like Poland, which still have to be organised, or those of Denmark and Norway, which still have to be liberated, is immensely greater than the estimated production. Fortunately, in some commodities a bad season in one country is set off by a good season in another. The heavy decline in the production of wheat in Australia due to the drought is set off to some extent by a bumper crop of wheat in North America. It is fortunate, too, that the bad season in Australia for meat and dairy produce has not

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been repeated in New Zealand, where the present season is unusually good; though the increased production in New Zealand cannot possibly replace more than a fractional proportion of the decreased production in Australia.

AVERTING REVOLUTION.

The vital problem for 1945 is to maintain the rations in the United Kingdom, and at the same time to meet the demand for foodstuffs with which to feed liberated Europe. It has recently been announced that France and Belgium are already making some progress in the production of their own food, though it is by no means clear to what extent local production may have to be supplemented by imports either of types of food which cannot be grown locally or of foodstuffs required in certain areas incapable of self-support. Even in peacetime both France and Belgium were considerable importers of some of the major foodstuffs. Holland will require special consideration in view of the devastation in many of her agricultural areas. In Greece, where the civil war seems happily to have come to an end, there will undoubtedly be difficult feeding problems; and no one can yet estimate what will be the requirements of Yugoslavia or, for that matter, of Russia herself, until the next harvest has been sown and reaped.

And what is to happen as regards Italy and as regards ex-enemies such as Hungary, Rumania, or Bulgaria, or to the neutrals, such as Sweden and Switzerland? The problem of Asia, and in particular of China, is, of course, well in the public mind as a result of the recent U.N.R.R.A. conference at Lapstone. The inhabitants of all these countries must be fed if only to avert revolution. Nothing breeds revolution more surely than hunger, and if there should be widespread revolution in Europe, how will the rest of the world escape?

GREAT AUSTRALIAN DROUGHT.

It is indeed unfortunate that at a time when the pressure upon world food supplies has been so greatly increased Australia should have been involved in one of the most calamitous droughts in her history. I found during my recent visit to London a widespread feeling of sympathy for the primary producers of Australia, whose great efforts to maintain production as their contribution to the war effort should have been so markedly frustrated by the weather. The people of Britain have heard how the primary producers in Australia, generally without adequate assistance, have stuck to the plough and to the harvester and to the milking-shed long after their age entitled them to honourable retirement. Their activities have fed the man under arms and the man and woman in the munition works. The people of Britain hope that, as has so often happened in the past, the season following the drought may prove exceptionally bountiful. Meantime, if exports from Australia to Britain should temporarily fall, the British people will carry on as best they can.

MORALE IN BRITAIN TO-DAY.

Nothing is more heartening to a visitor to the U.K. at the present time than the realisation that the British people will continue to see the war through whatever happens. This does not only apply to the fighting man. It applies to everyone. The man who drives the bus; the girl who collects your tuppence; the elderly woman who serves you in a store; the policeman who directs the traffic; the fireman who now spends much of his spare time in making toys for children with damaged timber recovered from devastated areas; the people who take comfort and assistance to victims who survey the ruins of what last night was their home; all these demonstrate beyond a peradventure (as President Wilson used to say) that nothing can deflate the essential spirit of Britain.

The British people will, however, feel it hard if their weekly 1s. 2d. worth of meat cannot be increased soon after the final German collapse. They know that there is no possibility of increasing the weekly ration of 2oz. of butter until some of the European countries get into production again, but they would fiercely resent any reduction in the 2oz. The people feel also that they should not be called upon to face another winter with only two pints of milk a week for each ordinary adult. It is therefore abundantly clear that for many years the U.K. will need all the meat and dairy produce which the Commonwealth can possibly make available to the home country.

LONG-TERM CONTRACTS.

That is why the U.K. Government have offered long-term contracts for the purchase of the whole of Australia's exportable surplus of various forms of meat and dairy produce. These contracts will enable producers to prepare their plans a long time ahead—to plough their paddocks, to breed their stock, to make whatever preparations are necessary to increase production as soon as the drought is broken. The producers will not have to consider the possibility of the kind of slump which played havoc with commodity values and land values after the first Great War. This time the market in the post-war period is completely assured for the commodities covered by the long-term contracts; and the producers can set to work to feed a hungry world without any anxious forebodings as to the capacity of the world to pay for the harvest when it is ready.

Changing Ideas in Soil Cultivation.

G. H. Burvill, Assistant Plant Nutrition Officer.

Note.—The text of this article was broadcast from National Stations in W.A. on 23rd September, 1943, in the series of Agricultural Broadcasts entitled "Farmers in a Changing World." From the enquiries received, especially in recent months, it is apparent that farmers are showing an increasing interest in new methods and ideas concerning soil cultivation, especially to combat soil erosion.

It is hoped, therefore, that the publication of this broadcast now will serve a useful purpose, as it brings together much information about cultivation, including new methods and older traditional practices.

The publication of the broadcast has the approval of the Australian Broadcasting Commission.

Cultivation Through the Centuries.

THE cultivation of the soil is an ancient art. For thousands of years man has been stirring and loosening the earth's surface soil with various tools and implements to make conditions more favourable for the seeds and plants he wished to grow for food.

Ploughing and cultivation were done for centuries with crude implements, and strongly ingrained traditions and beliefs became associated with them through centuries of trial and error.

The principles and problems of soil cultivation received little attention from scientists till about 60 years ago, and even so, some of the ideas first developed have been shown to be untenable. It is principally to a discussion of later and more recent findings that this talk is devoted.

Careful and thorough cultivation has long been regarded as the hallmark of good farming. In gardening practice too, everyone is familiar with the oft-repeated advice to "keep the hoe moving among the plants." It may therefore surprise you to know that many experiments have failed to substantiate the need for so much cultivation of the soil.

Too Much Cultivation Now Discouraged.

In many cases, on account of possible damage to soil structure, and the menace of soil erosion, too much cultivation is discouraged. Charles E. Kellogg, principal soil scientist of the United States Department of Agriculture, says in his recent book (1941) entitled "The Soils that Support Us"—"On the whole, modern farmers in the United States still plow and cultivate too much . . ." "Rather than 'plow deep while sluggards sleep,' one should plow well, at the proper time, and as little as possible, yet kill weeds, develop good seed beds and make the soil receptive to rainwater."

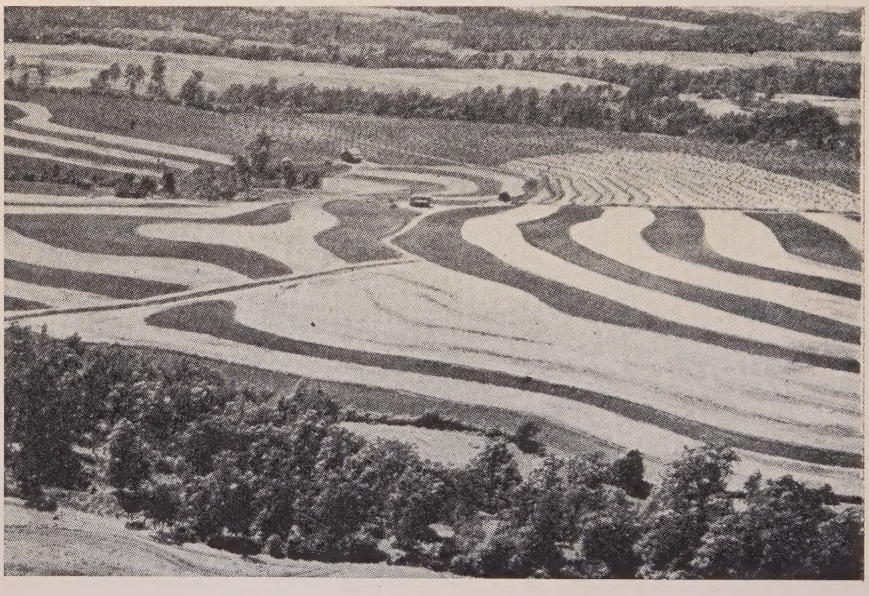


Fig. 1.

Winding strips of crop, pasture and cultivated land, following the contour of the country. The orchard in the background is also planted on the contour. Contour farming and strip cropping are now common in the U.S.A. where there has been a move away from "square farming in a round country."

[Reprinted from U.S.D.A. Misc. Pub. No. 411, 1940.]

How then, one may ask, arose the belief in the virtues of thorough, frequent and regular cultivation? Early ploughs were little more than pointed or crooked sticks, pulled by men, women, oxen or slaves. Such implements, little improved, are still used, as our Australian soldiers have seen, in Egypt, Palestine, India, and Malaya. The work of these implements, and even of much improved wooden ploughs of the 16th and 17th centuries in England, was very imperfect, both in weed control and seedbed preparation, compared with later and modern types developed since the Industrial Revolution. Extra cultivations were therefore necessary for any measure of success in crop growth. In the 14th century, the rough clods left by crude ploughs were broken up with wooden mallets.

Fig. 2.
"Stubble mulch" or "trashy fallow." To control soil erosion by wind and water, the leaving of large amounts of straw and trash on the surface is now widely advocated in the drier parts of the U.S.A.
[Reprinted from "Soil Conservation," U.S.A., Jan., 1942.]

Then too, there were influences, such as the teachings of Jethro Tull, who, about 1730, became the apostle of good cultivation. The methods by which plants absorb food materials from the soil was not known, but Tull, believing the roots obtained their food from the surface of the soil lumps, advocated thorough cultivation to break down the larger soil lumps and so increase the feeding surface.

The Soil Mulch in Dry Land Agriculture.

The development of dry land agriculture in the U.S.A. towards the end of last century also fostered the belief in thorough and regular soil cultivation. Here, moisture for crops was a limiting factor, and to retain the rainfall or irrigation water which had been applied, the creation of a loose dry layer or "mulch" of soil on the surface was strongly advocated. The advice had the backing of eminent scientists and was based on experiments they had carried out, often under laboratory conditions with soil in glass or metal tubes standing in reservoirs of water. The soil, absorbing water like a wick, was supposed to act like a bundle of fine capillary tubes and lift the water to the surface. Stirring and loosening the surface soil broke these tubes and saved water from evaporation loss at the surface. This experiment can be repeated today with similar results, but field conditions are usually quite different. There is often no reservoir of water within a few feet of the surface and capillary moisture movements are very slow. Moisture losses are not reduced by stirring the soil surface, though in some cases, a mulch of straw, grass, paper, sand or gravel is beneficial.

Careful experiments in America, England, Africa and Australia including Western Australia* have repeatedly confirmed this, during the past 30 years. These have also shown that weeds are a major factor in moisture losses. When

* See Burvill, G. H., Teakle, L. J. H., and Jones, L. T., "Soil Moisture Conservation in Orchards and Vineyards," *Jnl. Dept. Agric., W.A.*, Vol. XX., No. 3, Sept., 1943, pp. 224-236, Leaflet No. 750.

Fig. 3a.

Cultivators fitted with a few very wide sweeps or points as shown have been developed for cultivating beneath a stubble mulch.

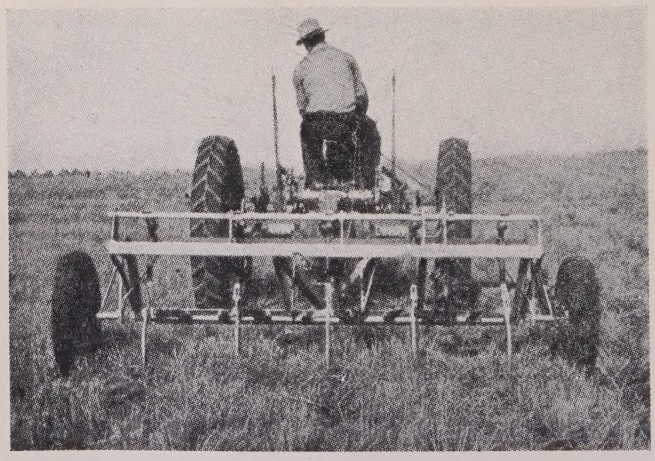


Fig 3b.

A subsurface tillage implement with wide sweep cultivating beneath a heavy stubble. The scene is in Nebraska where much research on subsurface tillage has been done.

[Reprinted from "Soil Conservation," U.S.A., Sep, 1944.]

moisture is precious, as it is during the dry summer months in Western Australia, cultivation to check growing weeds in orchards and vineyards and on fallows, is beneficial. Once most of the weeds are destroyed, there is no advantage in moisture conservation from further cultivation.

Fig. 4.
A deep furrow drill used for seeding stubble mulch fallow.
[Reprinted from "Soil Conservation," U.S.A., Jan., 1942.]

The Menace of Soil Erosion—Changed Cultivation Methods Necessary.

In the U.S.A. there has been a further notable trend. The nation and its farmers have developed an erosion consciousness since the disastrous duststorms of 1934, and floods of 1937. They are determined to check the wastage of that precious heritage, the surface soil. There has been a move away from "square farming in a round country," and pictures of alternating winding strips of crops, pastures and cultivated land, following the contour lines are now well-known to most of us. (See Fig. 1.) The soil is encouraged to absorb the rainfall where it falls, rather than let it run over bare surfaces and strip valuable top soil. Contour farming is supplemented by leaving as much as possible of straw and crop residues on the soil surface. (See Fig. 2.) The system is called "stubble mulch farming" and special cultivators, drills, and combines have been developed to work under this protective mantle which increases moisture absorption and breaks the force and the size of the pounding raindrops (Figs. 3 and 4.) It is also a valuable protection against wind erosion. "Nature was never a nudist by choice," an

American has aptly said. She always covered the soil with a mantle of vegetation. Descriptive terms like "trashy fallows," and "mulch tillage" are now common in farmers' bulletins issued from the United States of America. In Californian orchards, where the "dust mulch" was standard practice 20 years ago, cover crops are now lightly disced in spring, to eliminate them as moisture competitors, and yet leave them mostly on the surface to protect the soil from sudden storms. (Fig. 5.) Another practice is to establish annual grasses and clovers as cover crop, and to mow these once or twice with special mowers when they have formed enough seed for the following year. No cultivation is done at all. Likewise, in the irrigated citrus orchards on the Murrumbidgee in New South Wales, trees with permanent cover crop between them continue to thrive, while those which are clean cultivated deteriorate after about 15 years. Scientists studying the problem believe that the continual stirring of surface soil and the traffic of implements and animals have a bad effect on the surface soil. The mellowing effect of plant roots offsets this deterioration.

Another erosion problem which has called for changes in cultural methods is the windblowing of the mallee soils especially in Victoria and South Australia. The protective value of stubble, as in America, is recognised, and oats for grazing are planted on stubble with a Sunder-seeder or broadcast in front of a scarifier. Fallows are left rough, and worked into ridges at right angles to the prevailing wind. Paddocks to be fallowed for wheat are sometimes sown early in the season with rye corn to provide binding roots and trash when the land is later ploughed.

Time for Action in Western Australia.

In the rapid development of the Western Australian wheat belt between 1910 and 1930, stubble burning was a common practice. Sometimes this was done to control the fungous disease "take all," but more often because the straw was a hindrance in ploughing and seeding operations. When fallowing became more general, cultivation a number of times during the summer was believed to promote better yields. Except on limited areas, neither wind nor water erosion has yet become a serious menace, but this is the time to heed the lessons of other countries and change or adapt methods and systems of soil cultivation with the object of preserving the soil, as well as maintaining or improving crop yields. Experiments over many years at wheat belt research stations have shown no advantage from summer cultivations of fallows; even one spring cultivation after ploughing is of doubtful value unless weeds are numerous. Rough trashy fallows, with weeds mostly controlled by sheep, may therefore be advocated because of less liability to wind and water erosion. Cultivation just before seeding will produce the necessary seedbed.

The Inter-cultivation of Row Crops.

So far, I have dealt mainly with changing ideas in dry land cultivation. But many crops such as maize, cotton, sugarbeet, potatoes and others are grown where the rainfall or moisture conditions are such that conserving moisture from one season to the next is not necessary.

They are grown in rows, and the soil between can be cultivated or hoed while the crop is growing. Farmers and gardeners generally believe that such cultivation or hoeing produces benefits beyond that due to weed destruction. Again, however, careful experimentation has in general failed to support this belief.

Fig. 5.

Discing an annual cover crop in spring to leave much of the crop on the surface. This stops moisture losses through the growing crop and protects the soil from erosion and damage by late rains. A similar cultivation four to six weeks later will destroy weeds and further incorporate the cover crop with the surface soil.

[Reprinted from U.S.D.A. Farmer's Bulletin, No. 1917, 1942.]

The famous Rothamsted Experimental Station in England has been very active with cultivation experiments in recent years, and one of its workers has brought together as a background a large mass of experimental results.* With maize in the U.S.A. cultivation experiments are numerous and go back to 1887. They include the results of a standardised trial carried out 112 times between 1905 and 1911 and spread over a wide variety of soils in 28 States. Some plots were cultivated as was considered ideal in farming practice, others had weeds removed by scraping the surface with a sharp hoe. This did not loosen the soil surface, in fact in some cases, it produced a surface "dry and hard as a floor." Yet on the whole, grain yields averaged only 1 per cent. greater on cultivated plots compared with the scraped plots. In some seasons, the scraped plots gave up to 10 per cent. more than the cultivated; in other years the advantage was reversed. Experiments of the same type with vegetable crops in the U.S.A. have mostly given similar results. Carrots, cabbages, tomatoes, beet, onions and celery have been tried, and only with celery did cultivation give consistent yield increases compared with scraped plots. Potatoes, mangolds, kale and sugarbeet have also been the subjects of numerous and varied cultivation experiments in the U.S.A. and England, especially during the past 20 years. All experiments have shown advantages due to weed control, but in most cases this is the only advantage brought about by cultivation.

Even so, complete control of weeds is not always an advantage. Extra cultivations to check weeds have often produced lower yields, probably due to damage to the roots of the crop.

* Pereira, H C., "Crop Response to Inter-row Tillage," *Emp. J. Exp. Agric.*, Vol. 9, No. 33, 1941, pp. 29-42.

This aspect, and the time when it is of most advantage to cultivate, has been investigated both in England and the U.S.A. The English work done at Rothamsted and Woburn with sugarbeets, and some experiments with other crops, have shown that farm and garden crops are very sensitive to weed competition in their early stages, and cultivation for weed control at this time gives good results. But elimination of weeds later by cultivation, may give little or no benefit, especially on fertile soils.

The intercultivation of potatoes, and the ridging of the soil along the rows, has also been closely studied. The experiments are many, and have been carried on over a number of seasons in England and the U.S.A. The only advantage from ridging is to reduce the greening of the potato tubers near the soil surface. Level culture gives equally good yields and cultivations should be shallow and no more frequent than will give reasonable weed control. Even when potato tops are only six to eight inches tall, cultivation can cause damage to the roots. Ridging, if practised, should therefore be done as early as possible.

CONCLUSION.

So many carefully conducted experiments on cultivation have given results opposed to the traditional beliefs of farmers and gardeners that readers may ask, "Why cultivate at all?"

It should be remembered that a certain amount of cultivation is necessary to prepare a good seed-bed. Remember too, that nothing has been written to discourage cultivation to effect a moderate degree of weed control. Remember this especially, as the main advantage of cultivation, when next you are tempted to cultivate the fallow or the orchard, or are offered the gardener's traditional advice to "Keep the hoe moving among the plants."

The Citrus Red Scale.

C. F. H. Jenkins, Government Entomologist.

THE red scale (*Aonidiella aurantii* Masc.) has a wide distribution over the globe and is of greatest economic importance in those countries with a semi-arid climate such as California, South Africa, Palestine and Australia. The native home of the pest is probably China, but it has been known in Australia for about 60 years and it was from this continent that it was introduced into North America.

It has been described by authors as the most serious insect pest of citrus, and in many countries this is undoubtedly true. In Western Australia it is widely established, but probably owing to climatic and other conditions it is not the pest in this State that it is on the other side of the continent.

DESCRIPTION.

The adult female is an almost circular soft-bodied insect devoid of all powers of locomotion and protected by a hardened waxy test or scale, reddish-brown in colour and about 1/10th inch across. Like all bugs, to which group scales or coccids belong, this insect has sucking mouth parts, the sucking tube being produced into a remarkable hair-like organ far exceeding in length the whole body of the scale.

The male coccid is rarely seen, and differs greatly from the female. It has a pair of well-developed wings and a tuft of filamentous threads, forming a kind of tail. It passes its early development covered by a waxy scale, but when maturity is reached it pushes out from under its covering and goes forth in search of a mate. The male scales or actual coverings differ from those of the females in being rather smaller and oblong instead of circular in shape.

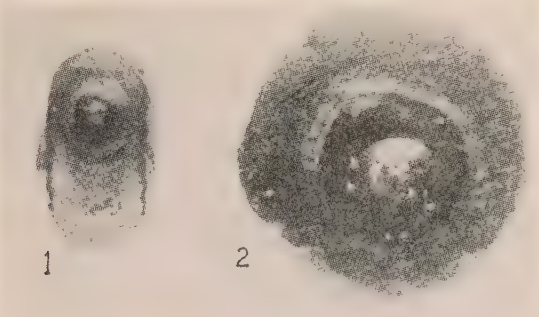


Fig. 1.
(1) Scale of male. (2) Scale of female (enlarged).
(Uni. Cal. Bul.)

(Uni. Cal. Bul.)

Fig. 2.
Male of Red Scale.
(Magnified by 40.)

LIFE HISTORY AND HABITS.

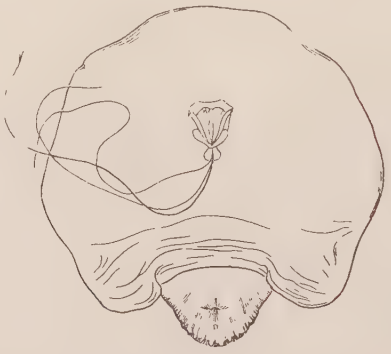
The red scale, unlike many coccids, does not lay eggs, but gives birth to living young. The young or larvae may remain under the protecting mother scale for a little while after birth, especially if the weather is cold.

The young scales, on emergence, are only just visible to the naked eye, and look like tiny yellow specks of sulphur. Under a lens they will be seen to have three pairs of functional legs and a pair of feelers or antennae.

As a rule the young or "crawlers" do not migrate very far, but settle down within a few inches of the parent. The active crawling stage may last a few hours or a couple of days, then the mouth parts are inserted into the plant tissue, the antennae and legs drawn in under the body and the first cottony threads of the covering scale appear. When finally settled down, the red scale remains fixed in position throughout life with the exception of the winged males.

After imbibing sap for some time the young scale moults its skin and at the same time loses its legs and antennae. It increases considerably in size and adds to the scale covering, then a second moult follows, after which it reaches maturity.

The time required to develop from crawler to adult will vary with the season of the year and the locality. The main breeding season in this State extends from November to May, when several generations may be developed. The exact details are not available for the local breeding rates, but in South Australia it has been shown that it takes about nine weeks in the summer and about 20 weeks in the winter for a newly-hatched female to be ready to give birth to the next generation. After commencing to produce young in the early summer, females



(Uni. Cal. Bul.)

Fig. 3.
Under side of female Red Scale showing hair-like mouth parts.
(Magnified by 50.)

may continue to give rise to crawlers for about two months, during which time 150 may be born. This reproduction may continue on fruits even after they have been picked and held in store. Normally, red scale does not reproduce during the winter. Individuals which have settled down just before the onset of the cold weather may go on developing slowly and be ready to breed the following summer, but many will perish.

METHOD OF DISPERSAL.

It is clear from what has already been said about the larval scales that their actual movements and activity have little to do with the spread and distribution of the pest. Factors of importance are the transport of infested trees and fruits, picking boxes, etc. Wind is probably the chief agent within an orchard, as "crawlers" are known to have been carried 400 ft. by this means. They have also been known to attach themselves to the bodies of birds and insects and thus be carried far afield.

HOST PLANTS.

No complete list of host plants in Western Australia is available, but the fact that in South Africa, no less than 200 plants have been listed, as carrying the scale, shows that citrus are by no means the only species attacked. Locally, in addition to all types of citrus it has been recorded from figs, mulberries, roses, apples, plums, vines, nectarines, pears, white cedar, castor oil and Zamia palms. Although it is of little economic importance on trees other than citrus, these alternative hosts must be considered when sources of infestation or carry-over in an orchard are being investigated.

Fig. 4.
Red Scale "Crawler."
(Magnified by 175.)
(Uni. Cal. Bul.)

Fig. 5.
Red Scale in orange leaf.
(Uni. Cal. Bul.)

TYPE OF INJURY AND ECONOMIC IMPORTANCE.

Red scale attacks all parts of the tree, leaves, fruit, twigs and branches. It may become so thick as to form an incrustation of over-lapping scales. It is the only common citrus scale in the State which actually infests the fruit and consequently it may be easily recognised on this account. Another characteristic is the yellow discolouration which may be seen around the feeding puncture, either on leaves or green fruits. Even when the scale has been rubbed off this evidence of its presence will persist for some time.

The first indication of the adverse effects of the scale is a yellowing and then a dropping of leaves. In bad infestations, the twigs and young branches may die back, to be followed finally by the death of the whole tree. Unlike the black and soft brown scale, the red scale does not secrete honey dew and so the unsightly accumulation of black sooty mould associated with the latter varieties is absent.

Red scale in Western Australia is by no means the all-important problem it is to citrus growers in the Eastern States. It is well established in the orange groves of Chittering, Harvey and the Darling Range, but is kept in check with nominal attention, compared with the efforts of growers elsewhere. There are possibly two reasons for this, one is that a parasite has been established locally on the pest but the main factor is probably the climatic conditions.

Fig. 6.
An orange tree showing effects of severe scale infestation.
(From U.S. Dept. Agric.)

As already stated, the red scale thrives mainly in districts where citrus are grown under semi-arid conditions, as in the light rainfall but irrigated areas of South Australia, Victoria and New South Wales. When the rainfall of Kalamunda or Harvey, approximately 35-40 inches, is compared with that of the Murray Basin, approximately 11 inches, this climatic difference will be readily appreciated. Even

in our own State the incidence of the pest in the hills districts and Harvey is different from that found at Chittering and Gosnells, while the position at Carnarvon probably the most seriously affected district in Western Australia, has no counterpart in the south-western portions of the State.

CONTROL.

Two standard control methods are employed against the red scale, namely, oil spraying and cyanide fumigation. It has been found, more especially in America, that certain individuals have an extraordinary power of resisting cyanide gas and that a resistant variety of scale is being developed.

OIL SPRAYS.

The most generally used control in this State is white oil applied in the later summer at a strength of one part to 40 of water.

In applying oil sprays it is essential that the work be done thoroughly with a high-pressure pump for the oil depends entirely upon contact for its effectiveness, and so must be made to reach the under surface of leaves and the denser parts of the tree. Spraying, however, should not be done during a heat wave or when trees are stressed for want of water, otherwise injury to foliage may result.

Fig. 7.
Lemon heavily infested with Red Scale.

FUMIGATION.

Hydrocyanic acid gas is probably the most universally used agent for scale control, although in Western Australia it has only a limited number of exponents. It may be generated either by the old pot method in which the gas is evolved through the interaction of potassium or sodium cyanide, with sulphuric acid and

water or by means of calcium cyanide which is available in both dust and briquette form. Liquid cyanide has also been used satisfactorily in some countries.

The dosage should be carefully measured according to the size of the tree and the time of the year. Other precautions to observe are as follows:—

1. Do not apply fumigation to trees previously treated with copper sprays until a period of six months has elapsed unless the effect on one or two trees has first been tested.

2. Do not attempt to fumigate trees carrying free moisture, either in the form of rain or dew. Ill effects may also follow the use of damp sheets.

3. High temperatures and bright light will increase the risk of foliage injury. (For this reason fumigation is usually done at night.)

4. Do not fumigate in less than a fortnight after applying an oil spray.

Dosage.

The ingredients are mixed in the following proportions:—

Potassium cyanide—1oz.
Water—3 fluid oz. (6 tablespoons).
Sulphuric acid—1 fluid oz.

If sodium cyanide is used the proportion of sulphuric acid should be increased to 1½ oz. and the water reduced to 2 oz.

A glazed earthen-ware vessel is usually used as a container and the water should be poured in first. The sulphuric acid should then be added very slowly and the pot placed under the fumigation tent near the trunk of the tree.

After the cyanide wrapped in paper has been added the tent should be quickly dropped and the junction with the ground sealed with heaped up earth.

The amount of fumigant necessary will vary with the size of the tree and the following tables based upon recommendations of the Queensland Department of Agriculture are included.

The duration of the fumigation is usually 45 minutes.

Fig 8.
Measuring a tent for determining of fumigation dosage.
(S. Aust. Jour. Agric.)

Tents.

The most durable sheets or tents are made from 8 oz. army duck, although lighter material, including medium weight closely woven calico, has been satisfactorily employed. Tents are usually eight sided and the diameter varies with the size of the trees to be covered. A 36 foot sheet should be suitable for an average tree 12 feet in height.

COMBINATION TREATMENTS.

Where heavy red scale infestations occur and where a thorough clean up is desired, the application of oil followed by fumigation has been found most successful.

Oil sprays as may be expected are less effective against insects on the wood and interior portion of the tree, whereas the fumigant readily reaches these individuals, while its concentration on the outer parts of the tree may be rather light. It will therefore be seen that spraying and fumigation may be regarded as complementary treatments. The first week in February is about the latest that oil sprays should be applied if scale is bad and clean fruit is desired, for although a heavy kill may be obtained from later sprays, the dead scales may fail to drop before the fruit is harvested. If a following fumigation is contemplated, it has been shown in South Australia, that this may be given a month or two months later with equally satisfactory results.

BIOLOGICAL CONTROL.

Exhaustive efforts have been made in many parts of the world to discover effective parasites and predators of the red scale. One giving early promise was a tiny yellow wasp *Aphytis chrysomphali* (Mercet.), collected in China and introduced in Western Australia in 1905. It is widely established locally and in some districts plays a part in keeping the scale population within reasonable bounds.

In February, 1943, a further wasp parasite *Comperiella bifasciata* (How.), was introduced through the co-operation C.S.I.R. and liberations were made at Harvey, Guildford, Parkerville and Gosnells. No field recoveries have yet been made, however, and it is still too early to pronounce any judgment upon this last importation.

TABLE 1.

POTASSIUM CYANIDE.

45 Minutes Exposure.

Diameter of Tree (feet).

Height of Tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
5	1	1	1	1½	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
6	....	1½	1½	2	2	2½	3	4	4	....	....	....	....	....	....	....	....	....	....	6
7	....	1½	1½	2	2½	3	4	4	4	5	....	....	....	....	....	....	....	....	....	7
8	....	....	....	2½	3	3	4	4	5	6	6	6	7	....	....	....	....	....	....	8
9	....	....	....	2½	3	3	4	4	5	5	6	6	7	7	....	....	....	....	....	9
10	....	....	....	3	3	4	4	4	5	5	6	6	7	8	9	....	....	....	....	10
11	....	....	....	....	4	5	5	5	6	6	7	7	8	9	10	....	....	....	....	11
12	....	....	....	....	....	5	5	6	6	6	7	8	8	10	11	12	13	15	17	12
13	....	....	....	....	....	6	6	7	7	7	8	9	9	12	13	14	15	16	18	13
14	....	....	....	....	....	....	6	7	7	8	9	10	11	13	14	15	17	18	18	14
15	....	....	....	....	....	....	....	7	8	8	10	11	12	14	14	16	18	20	20	15
16	....	....	....	....	....	....	....	....	9	10	12	12	13	14	15	17	18	20	21	16
17	....	....	....	....	....	....	....	....	....	12	13	13	14	15	16	18	20	22	22	17
18	....	....	....	....	....	....	....	....	....	....	13	13	15	16	18	20	22	23	24	18
19	....	....	....	....	....	....	....	....	....	....	....	15	16	18	19	21	23	25	25	19
20	....	....	....	....	....	....	....	....	....	....	....	....	17	19	21	23	24	25	26	20
21	....	....	....	....	....	....	....	....	....	....	....	....	19	19	21	23	25	26	27	21
22	....	....	....	....	....	....	....	....	....	....	....	....	....	21	22	24	25	26	27	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Dosage in Ounces.

Proportion—Water, 3; Sulphuric Acid, 1; Potassium Cyanide, 1.

TABLE II.
CYANOGAS DUST.
45 Minutes Exposure.
Diameter of Tree (feet).

Height of Tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1	1½	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
5	1	1	1½	1½	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
6	1	1½	1½	1½	2	2½	3	4	4	....	....	....	....	....	....	....	....	....	....	6
7	1	1½	1½	2	2½	2½	3½	4	5	5½	....	....	....	....	....	....	....	....	....	7
8	....	1½	1½	2	2½	3	4	4½	5½	6½	7½	8½	10	....	....	....	....	....	....	8
9	....	....	2	2½	2½	4	4½	5	6	7	8½	9½	11	12½	....	....	....	....	....	9
10	....	....	....	2½	3	4	4½	6	7	8	9½	10½	12	14	15½	....	....	....	....	10
11	....	....	....	....	3½	4½	5	6½	7½	9	10	12	13½	15	17	19	....	....	....	11
12	....	....	....	....	3½	4½	6	7	8	10	11	13	14½	16½	18½	20½	23	25	27½	12
13	....	....	....	....	....	....	6	7½	9	10½	12	14	16	18	20	22	24½	27	30	13
14	....	....	....	....	....	....	7	8	9½	11	13	15	17	19	21½	24	26½	29	32	14
15	....	....	....	....	....	....	....	8½	10	12	14	16	18	20½	23	25½	28½	31	34	15
16	....	....	....	....	....	....	....	9	11	13	15	17	19½	22	24½	27½	30½	33½	36½	16
17	....	....	....	....	....	....	....	....	11½	13½	16	18	20½	23	26	29	32	35½	39	17
18	....	....	....	....	....	....	....	....	12½	14½	17	19	22	24½	27½	31	34	37½	41	18
19	....	....	....	....	....	....	....	....	13	15½	18	20½	23	25	29	32½	36	39½	43½	19
20	....	....	....	....	....	....	....	....	13½	16	18½	21½	24½	27½	30½	34	38	42	46	20
21	....	....	....	....	....	....	....	....	....	....	....	22½	25½	29	32½	36	39½	44	48	21
22	....	....	....	....	....	....	....	....	....	....	....	23½	26½	30	34	37½	41½	46	50½	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Dosage in Ounces.

TABLE III.
CALCID BRIQUETTES.
40 Minutes Exposure.
Diameter of Tree (feet).

Height of Tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1½	1½	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
5	1	1	1½	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
6	1	1½	1½	2	2½	2½	3	3½	4	....	....	....	....	....	....	....	....	....	....	6
7	1	1½	2	2	2½	3	3½	4	4½	5	....	....	....	....	....	....	....	....	....	7
8	....	1½	2	2½	2½	3	3½	4½	5	5½	5½	6	7	....	....	....	....	....	....	8
9	....	....	2	2½	3	3½	4	5	5½	5½	6	7	8	9	....	....	....	....	....	9
10	....	....	....	2½	3	3½	4½	5	5	6	7	8	9	10	11	....	....	....	....	10
11	....	....	....	....	3½	4	4½	5	6	7	8	9	10	11	12	13	....	....	....	11
12	....	....	....	....	3½	4	5	5	6	7	8	10	11	12	13	14	16	17	19	12
13	....	....	....	....	....	....	6	6	6	7	9	10	11	13	14	16	18	20	22	13
14	....	....	....	....	....	....	6	6	7	8	9	11	12	14	16	17	19	21	23	14
15	....	....	....	....	....	....	....	6	7	8	10	11	13	15	17	19	21	23	25	15
16	....	....	....	....	....	....	....	7	8	9	11	12	14	16	18	20	22	24	27	16
17	....	....	....	....	....	....	....	....	8	10	11	13	15	17	19	21	24	26	29	17
18	....	....	....	....	....	....	....	....	9	10	12	14	16	18	20	22	25	28	30	18
19	....	....	....	....	....	....	....	....	10	11	13	15	17	19	21	24	26	29	32	19
20	....	....	....	....	....	....	....	....	10	11	13	15	18	20	22	25	28	31	34	20
21	....	....	....	....	....	....	....	....	....	....	....	16	19	21	24	26	29	32	35	21
22	....	....	....	....	....	....	....	....	....	....	....	17	19	22	25	28	31	34	37	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Dosage in Number of Briquettes.

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Notes on Pollen and Pollen Substitutes.

L. Blair, Government Apiculturist.

POLLEN is one of the essential foods of bees. The other is nectar or honey. Bees as a rule visit only one kind of flower on the same trip when collecting pollen, thus ensuring that pollination of each species of bloom shall be true to type. When a bee returns to the hive with a load of pollen, it selects a cell in the comb in which to deposit the pollen, after which another worker enters the cell head first, macerates the pollen and packs it in the bottom of the cell, adding honey and other secretions which change the chemical constitution, thus preserving it for future use. Pollen is an essential food of young bees in their larval (grub) stage and it also forms part of the diet of mature bees. A lack of it in the hive generally results in low condition of the occupants and, in consequence, they are unable to take full advantage of any nectar available. Reproduction also suffers.

Decreased numbers and enfeebled stamina may in some instances reduce the crop by 75 per cent. and if conditions are not improved the hive may become a total loss. Furthermore, young bees hatched in these hives are not vigorous and because the glands which produce Royal jelly, a thick milk-like substance that is fed to the young larva, are not fully developed, the degeneracy is accentuated by the young larva being under-nourished and their life is considerably shortened after reaching the adult stage. This condition often results in the Queen being superseded, and the new Queen would be inferior to one who had plenty of good food while in the larval stage. When there is a shortage of pollen, it is necessary to provide a substitute. If left to their own devices, bees will visit stables or barns in search of pollard or flour, but the observant apiarist will provide a suitable and readily accessible substitute. Unfortunately, the main ingredients of such a mixture, either soya bean flour or cottonseed meal, are almost unprocurable in any quantity in Australia at the present time, being grown mainly in Japanese held territory. Many experiments have been conducted in various parts of the world with a view to determining the efficacy of meals, straight and in combination, as pollen substitutes, but in the majority of cases the young brood that reach maturity are short lived, with glands in various stages of atrophy. Hereunder are a few recipes given in order of merit as substitutes for pollen:—

1. Soya bean flour 80 per cent., dried skim milk 20 per cent. The soya bean flour should be expeller-processed with a fat content of 6 or 7 per cent. Solvent extracted soya bean flour with a low fat content should not be used.

2. Cotton seed meal 80 per cent., dried skim milk 20 per cent. is credited as the next best (by M. H. Haydak and M. C. Tanquary, University of Minnesota, U.S.A.).

The Council for Scientific and Industrial Research laboratory did a considerable amount of research on pollen substitute, as a result of which the following is suggested:—

Pure casein, 25 parts.
Dried yeast, 1 part.
Pollard, 6 parts.
Pea flour, 1 part.
Dried milk, 1 part.

These substitutes can be given dry, placed in shallow trays or in an empty hive body in a sunny position around the apiary. If the latter is used, a couple of sticks should be placed under the lid to allow of easy entrance for the bees, and at the same time exclude dew and rain. This method is quick and easy for the

apiarist who has hundreds of hives. Another method is to give the mixtures in cake form on top of the frames; in this case it is advisable to proceed as follows:—Mix two parts of honey or crystal sugar with one part of hot water; 4 quarts of the resulting syrup are thoroughly mixed with 5 lbs. of dry pollen substitute and allowed to stand for a day, after which the mixture is spread ¼in. to ½in. thick on waxed paper. Very favourable reports have been received of a mixture of from 25 per cent. to 50 per cent. of natural pollen mixed with soya bean flour, but in this case, however, it would be necessary for the apiarist to provide pollen traps on some of his best hives, and to store this pollen until such time as it may be required.

A good strong colony will use from 40 to 50 lbs. of pollen a year, and as much as 70 lbs. of pollen has been trapped from one colony in a year.

Description of a Pollen Trap.

A wire mesh, gauging four holes to the inch, is placed before the entrance to the hive and so arranged that the bees must pass through the mesh when entering and leaving the hive (bees will need a day or so to get used to it). Beneath the mesh is a pollen tray the same length as the mesh and about 3in. x 3in. covered on top with a finer mesh gauging seven holes to the linear inch, which allows the pollen to fall through and keeps the bees out of the tray. Over all there is placed a storm shield of wood or iron to exclude the rain, set at an angle and showing about 8in. projection. It will be necessary to raise the hive to accommodate the tray, and the bottom board should be flush with the hive at the entrance. It is advisable to have both trap tray and storm shield made detachable.

Drying the Pollen.

During a good pollen period the tray may need emptying in two to five days. In dry summer weather the pollen can be spread on shelves under shelter to dry. When dried sufficiently to prevent pellets sticking together, they can be stored in jars or tins; a clean dry honey tin would be good. It is important to keep out moisture and moths, as moisture would cause mould to develop and wax moths breed in pollen. In damp weather pollen can be spread out in a warm room to dry.

The Bean Mosaic Menace.

W. P. Cass Smith, Plant Pathologist.

BEAN mosaic is a widespread disease, which is caused by an infective principle or virus present in the sap of mosaic-affected plants. The disease has been noticed here on all the commonly grown French and runner bean varieties, and also on the Small White Navy bean which has been grown to some extent since the war. Unlike most viruses bean mosaic is seed-borne, and its introduction to new areas, and survival from season to season are largely due to the planting of infected seed. Plants raised from infected seed serve as reservoirs from which the disease is spread to healthy ones by sucking insects such as aphids.

Evidence is not lacking to show that, during the last year or two, bean mosaic has increased rather alarmingly. In April and May, 1944, a vegetable disease survey was made in a number of districts including Wanneroo, Balcatta, Osborne Park and Spearwood, when the increasing prevalence of bean mosaic was noticed.

Both French and runner bean varieties were affected, but especially crops of the widely grown "white seeded runner" pole bean (Syn. Prolific, Abundance, Golden Harvest).

In one or two instances the disease had caused almost total failure; the majority of crops showed approximately 50 per cent. infection, while a few showed from a trace only up to 20 per cent. In general, growers of badly infected crops all complained of deteriorating yields, and gave various reasons to account for this occurrence, including insufficient and low quality fertiliser, poor seasons, etc.; but, with few exceptions, they were quite unaware of the major reason for this decline, namely the widespread occurrence of bean mosaic. Although not so spectacular in its effects as, say, rust with which growers are quite familiar, mosaic should not be overlooked, for it is an insidious trouble, capable of causing serious reduction in yield.

Fig. 1.

French bean leaves of the "Vincent" variety (top) and "white seeded runner" pole bean (syn. Prolific, Abundance, Golden Harvest), leaves (at bottom) showing symptoms of bean mosaic. Note particularly the mottling, and downward-cupping of the leaves, and the raised, dark blister-like areas, which show prominently on the leaves on right.

Following this survey, steps were taken with the object of producing, under departmental supervision, disease-free seed from the healthiest crops of good type, but stocks are not yet generally available. Meanwhile, however, growers can do much to help themselves by becoming familiar with the symptoms and nature of the disease, and by adopting the measures required to control it.

SYMPTOMS AND EFFECTS.

The characteristic symptoms of mosaic include mottling and malformation of the foliage, stunting of plants and delayed maturity. However, symptoms may vary somewhat according to the variety, the environmental conditions in which it is grown, and the time of infection.

Plants grown from infected seed often show symptoms on the first trifoliate leaf, consisting of light green or yellowish, and dark green, irregularly shaped areas. In addition the margins of the leaflets are generally cupped downwards or otherwise distorted. Later-formed leaves may, in addition, develop considerable puckering, or blistering in the form of raised dark green areas and show reduction in size. Very occasionally, raised dark green areas may appear on the pods also. Bean mosaic seldom kills the plants outright, but those grown from infected seed give little yield. Plants becoming diseased at a later stage produce more seed but a considerable percentage is infected with mosaic. Also the market quality is reduced, for the pods are generally late-maturing and undersized.

To test the effect of the disease on bean yield, 50 healthy and 50 mosaic-affected French bean plants of the Vincent variety were harvested from a crop belonging to a Balcatta grower. The mosaic-affected plants gave only one-third of the healthy plant yield and, furthermore, under commercial conditions they would have yielded even less, for as they matured much later than the healthy plants, and were of poor quality, the extra pickings involved would not have been profitable.

REASONS FOR THE INCREASE OF BEAN MOSAIC.

It would appear that the recent increase of bean mosaic is largely due to the following reasons:—

Prior to the war the bulk of the bean seed used in Western Australia was raised by a few competent local growers, who carefully selected for type, and rogued out mosaic-affected plants. Since the war, however, seed production has become much less attractive, owing to the proportionately higher prices offering for green beans, and the opportunities which have arisen for growing other more profitable crops. In consequence, good quality bean seed, especially of the popular white-seeded runner variety, has become practically unobtainable and thus many growers who formerly purchased their seed supplies have now been forced to raise their own. With few exceptions, these new seed growers have not realised the seriousness of bean mosaic, and rogueing-out of diseased plants has not been carried out.

Also, owing no doubt to the attractive green bean prices, the practice has arisen of reserving the inferior "tail-end" portion of a crop for seed, rather than the best of the crop from a few specially selected rows, or small seed plot. This practice cannot be too strongly condemned, for as bean mosaic infects the seed and delays maturity, it is obvious that the amount of infected seed may be seriously increased when only the late-maturing or "tail-end" portion of the crop is saved for seed.

Recently the price of pole bean seed has been raised considerably, and this will do much to simplify the production of selected disease-free seed raised under departmental supervision.

Fig. 2.—Bacterial blight of beans, as it appears on the leaves. Note on left, the brown dead areas (after Harter and Zaumeyer), and on right the yellow halo spots. The latter symptom is most in evidence during cool weather.

CONTROL MEASURES.

As plants which become diseased from infected seed are the source of mosaic in the crop, the aim should be to plant only high quality disease-free seed. Reliable seed of this kind is very scarce at present and even improved selected seed, when obtainable, will be in short supply for some little time to come.

Growers should, therefore, raise their own stocks in a special seed plot, using the best available seed for this purpose. The plot should be well isolated to prevent the spread of infection caused by an invasion of aphids from near-by infected bean crops, and it should be grown during a period when aphid infestation is least likely to occur.

According to the Government Entomologist, Mr. C. F. H. Jenkins, aphids are usually most prevalent in the cooler spring months, and to a lesser extent in autumn, whereas during the hotter weather they are reduced to a minimum. To escape aphid-transmitted infection, therefore, the planting of the seed crop should be delayed until the advent of warmer weather in early summer.

Rogueing-out of diseased plants should commence as soon as the first trifoliate leaves appear, and be repeated at least once a week for the first month, and thereafter at fortnightly intervals throughout the growing season. More frequent rogueing is required at first to eliminate as soon as possible any plants which become diseased from the seed, for these are a potential source of infection for the remaining healthy plants.

To facilitate the rogueing of "white-seeded runner" or other pole bean varieties the plants should be trained up single poles, set vertically in the ground, and spaced a little wider in the rows than usual. When the poles are "criss-crossed" in the customary manner, mosaic-affected plants can only be traced back

with difficulty owing to the tangled growth, and rogueing becomes a laborious procedure. Also it is impossible to remove any but early-affected plants from the poles without damaging the healthy adjacent ones, and possibly transmitting the disease to them mechanically, and they must, therefore, be pulled up by the roots and left to wither.

Fig. 3.—French bean plant affected with bacterial blight. Note that only a few withered leaves remain, the rest having fallen. Note also the dark elongated lesions on the stem and the more or less circular pod spots.

The foregoing control measures have already been tested under local conditions in connection with the production of improved selected seed, and by their application it has been possible to reduce the amount of mosaic, from approximately ten per cent. in the first rogued crop to less than one per cent. of seed-borne infection in the second crop. While rogueing is being carried out any plants affected

with the bacterial disease "halo blight" (see fig. 2) or other diseases should be removed at the same time. Finally, when the crop becomes mature, seed should be selected from good type heavy yielding plants, and in the case of the "white-seeded runner" variety, off-type plants bearing flat instead of round pods should be discarded.

From the illustrations and descriptions given most growers should have little trouble in recognising the diseases mentioned, but if difficulty is experienced application should be made to the Plant Pathology Branch of the Department of Agriculture when, if possible, assistance will be given.

1944-45 Apple and Pear Crops and Estimates of Production of other Fruit Crops Grown in Western Australia.

H. R. Powell, Superintendent of Horticulture.

THE main apple growing districts are situated in the South-Western and Great Southern portions of the State; in addition, lesser quantities are grown in the valleys of the Darling Ranges, within a radius of forty miles from the city of Perth.

Normal climatic and soil conditions are very favourable for the production of good quality fruit. Before the outbreak of war, Western Australian export apples—particularly Granny Smiths were well and favourably known throughout the United Kingdom, and other importing countries.

In addition to favourable growing conditions, growers here have been fortunate in that several of the most serious insect pests and diseases of apples have never become established. In the case of codlin moth and apple scab, outbreaks that have occurred in the past have been successfully eradicated.

At the present time, or rather in 1944 when the last census figures were taken by the Statistician, there were 1,192,048 apple trees planted in the State; of this quantity 1,115,365 were trees of bearing age and 76,683 were trees of non-bearing age. The total area under apples is approximately 12,000 acres.

The apple and pear industry has been greatly affected by the conditions arising out of the war. There have been great shortages of labour, fertiliser and orchard requisites and these difficulties have had considerable effects on the apple orchards in the State. Normally it is the custom of growers to replant portions of their orchards each year that go out of production owing to age and disease. During the war years there have been very little fresh plantings and consequently the areas going out of production are not being replaced.

As far as the present season is concerned, a heavy responsibility is being placed on growers and packing sheds for it is estimated that out of an estimated crop of 1,490,000 bushels of apples and 118,000 bushels of pears, at least 900,000 bushels of apples and pears will be required packed and that a further 300,000 bushels of apples will be required to be delivered to factories processing such by-products as dehydrated apples, pie-pack and apple juices.

The following information relates to the present growing season and includes notes on early crop prospects, estimates of production, growing conditions and crop losses due to such factors as hail, frost, birds and insects and disease.

Flowering.—Although the previous summer had been severe, and the winter rains below average, the flowering was good, with the exception of Romes, Nickajacks and trees of all varieties that had carried heavy crops under adverse circumstances during the 1943-44 season. Due to the dry conditions, fears were expressed by some growers that thrips would be numerous and possibly cause sévere damage. Fortunately, this did not eventuate, and as was the case the previous year, very few of these insects could be found in the flowers right throughout the blossoming period.

Setting.—The setting did not come up to expectations and even trees that set heavily, shed more heavily than usual. As far as the individual varieties are concerned, Jonathans set a fairly uniform crop throughout the State. Granny Smith, Cleopatras, Yates and Doughertys are carrying medium crops, which may approximate to last season's production should growing conditions be favourable. The late varieties including Rome-Beautys and Nickajacks have, in all districts set poor to medium crops. Varieties such as Delicious, Rokewoods, Dunns and Statesman are extremely variable, being in some orchards good and in others very light.

Growing Conditions.—Growing conditions up to the end of December were good; at that time fruit size was above average and tree growth, though weak in many instances at the beginning of the season, was healthy. Weather conditions during January and February have been very dry in all fruit growing districts. In addition to the dry weather, severe temperatures and strong easterly winds have affected subsequent development of the fruit. In many orchards, Jonathans and Cleopatras are badly scorched and heavy crop trees on heavy land in some districts are carrying a large proportion of undersized fruits. Tree growth, however, has not been greatly restricted and it is expected that should average rains fall during March and April, the position will be retrieved.

The amount of slightly malformed or dimpled fruit is somewhat greater than normal; the varieties most affected are Jonathans, Cleopatras and Granny Smiths. No cause of "dimpling" has yet been discovered.

During each season items of interest can usually be found and this year is no exception. Perhaps the most outstanding feature of the season was the advanced maturity of all varieties of stone fruit; in all districts they were approximately ten days ahead of normal. Apples and pears particularly during early January were similarly advanced, but the dry hot weather conditions experienced subsequently have retarded maturity. Another unusual feature is that the Granny Smith crop is to a large extent confined to on-year trees.

Normally a considerable quantity of fruit is carried by trees other than those that are definitely in their on-year. It is also remarkable that despite an excellent flowering, Dunns have set very poorly in all districts except Mount Barker.

Unfortunately some damage has been caused to apple crops through the following agencies.

Climbing Cutworm.—The damage caused by climbing cutworm was extensive and in some orchards considerable damage was done. However, on orchards that were thinned, a considerable quantity of the damaged fruit was removed. It can be pointed out that growers who applied lead arsenate sprays to their trees during the first week in November to control curculio beetle and looper practically escaped damage.

Frosts.—Severe frosts occurred in many parts of the State during the fourth week in October and caused considerable damage to fruit crops generally. As far as apples are concerned apparently minor damage was caused over a wide area

extending from Donnybrook to Bridgetown and Boyup Brook. Where the frosts were severe, particularly in those portions of orchards situated on the lower levels of fairly steep valleys, very little fruit was left on the trees. Further up the slopes the fruit was damaged to a greater or lesser extent. On the green and yellow varieties such as Granny Smith and Cleopatras, splitting and subsequent malformation is common. The red varieties are in the main undamaged except that some frost banding has taken place.

Hail.—Scattered hail storms have been responsible for considerable damage being caused on individual orchards in the Mount Barker, Bridgetown and Denmark districts.

Birds.—Apparently due to the dry weather conditions experienced during January and February and the lack of natural food, parrots and black cockatoos have caused considerable damage to apple crops throughout the State. Unfortunately many fruit growers have not the necessary labour to protect their crops by continued shooting and it is feard that the quantity of Yates and Dougherty apples will be greatly reduced.

Pests Generally.—Although the incidence of pests and diseases have not been severe the most conspicuous have been the apple curculio in the south-western districts and powdery mildew in the Great Southern districts. There are hopes that the new insecticide D.D.T. will prove effective in controlling curculio.

APPLE CROP.

Crop Estimates.

Variety.	Fancy and Better Grade.	Production 1943-44.
	Bushels.	Bushels.
Jonathans	195,000	153,334
Cleopatras	309,000	365,142
Dunns	108,000	201,952
Delicious	21,000	29,599
Rokewoods	34,500	40,706
Granny Smiths	472,000	608,197
Yates	142,000	129,616
Dougherty	25,000	19,198
Other varieties	48,000	61,807
	1,354,500	1,609,551
Good Grade Estimate 10 per cent.	135,450	
Total	1,490,000 approx.	

PEAR CROPS.

The growing of pears is on a comparatively small scale in Western Australia. With the exception of Bartletts and Keiffers, the majority of the varieties were grown for the export trade to the United Kingdom.

The following notes pertain to the present growing season:—

The flowering of pear trees throughout the State was excellent and there was every indication of an excellent crop, particularly as the crop had been relatively light during the previous year.

The initial setting was very heavy, but unfortunately severe shedding occurred and with the exception of Bartletts and Josephines, the crop is only a medium one.

The growing conditions have been similar to that described under apples. Fortunately the late varieties made excellent growth during the earlier part of the season and have thus not been so greatly affected by the dry conditions

experienced over the last two months. Some damage to the crop has been caused by the climbing cut worm and pear scab.

Crop Estimates.

Variety.	Fancy and Better Grade. Bushels.	Production 1943-44. Bushels.
Bartletts	32,000	22,532
Packhams	9,000	8,891
Josephines	21,000	15,145
Comice	6,000	12,614
Winter Nelis	8,000	9,922
B. Bosc.	7,000	5,458
Keiffer	5,000	5,926
Other varieties	10,000	13,075
	98,000	93,562
Good Grade Estimate 20 per cent.	19,600	
Total	118,000 approx.	

CITRUS.

Citrus crops throughout the State are not uniformly heavy; in most districts however, they are good with the exception of the Capel-Donnybrook area where the crop was seriously reduced by severe frosts experienced during the previous October. At the present time fruit size is only fair, due to the dry growing conditions experienced during January and February.

Crop Estimates.

	Bushels.	1944 Production. Bushels.
Oranges	295,000	279,707
Lemons	60,000	88,710
Grapefruit	13,000	16,832
Mandarines	14,500	15,973

DRIED VINE FRUITS.

The production of dried vine fruits will not be as great this season as was the case last year. Due to the humid weather conditions experienced during November and December, sultana vines and fruit have been affected with Anthracnose to a much greater extent than usual. Through this cause it is evident that the quality of the crop will be substantially reduced.

The currant crop although not heavy, is good. Although some damage has been caused by the severe growing conditions, there is every prospect that quality will be up to the high standards set by former years.

The muscatel crop is a medium one but as this variety is also used for both table and wine purposes, it is very difficult to forecast the quantity that will be available for drying.

Crop Estimates.

	Tons.	1944. Production. Tons.
Currants	2,800	3,334
Sultanas	400	634
Lexias	100	69

STONE FRUIT.

The setting of stone fruits generally was not nearly as good as was the case last year. It is estimated that the production of peaches will be down at least 33 per cent. The varieties most affected were—Anzac, Briggs, Carmen and Wiggins. Certain varieties set fair to good crops in all districts and these included Elbertas, Rowes Red Slips and Ruby Reds. In some instances the development of colour was poor owing to the dry hot weather experienced.

Excluding Goldmines, most varieties of nectarines set light to medium crops. As Goldmines however, are extensively planted throughout the State, it is not expected that production will be much below last year's.

It is expected that the production of apricots will be down this season. Newcastle Early usually a consistent bearer, failed to set commercial crops in a number of districts.

With the exception of Wicksons, all varieties of Japanese plums are down on last year's production. The varieties most affected were Wilson, Santa Rosa, Climax and Satsuma. English plums, particularly President and Grand Duke also carried lighter crops than usual.

Crop Estimates.

Variety	Fancy and Better Grade.	Production. 1943-44.
	Bushels.	Bushels.
Peaches	40,000	66,798
Nectarines	17,000	19,792
Plums	60,000	81,873
Apricots	45,000	72,000
	162,000	240,463

Questions and Answers relating to Pig Management.

R. R. RUTHERFORD, Farm Manager and Demonstrator, Muresk Agricultural College.

FROM time to time queries are raised regarding pig management and it is the writer's intention to summarise some of these queries in the form of questions and answers.

Question.—Is a pig a clean animal? Many people associate pigs with filth and unpleasant odours.

Answer.—A pig is as clean as his master permits him to be. If given the opportunity pigs are as clean as any other animal, and will repay their master for such clean conditions by their thriftiness and comparative freedom from disease.

Question.—What is the period of gestation in a sow?

Answer.—Sixteen weeks. 112 days.

Question.—How long does oestrus or sexual heat in a sow last and when does it occur?

Answer.—The condition lasts from 2-4 days and recurs every 3 weeks until pregnancy occurs.

Question.—At what age can young sows be mated?

Answer.—Sows should not be mated until 9-10 months old unless they are well developed for their age.

Question.—At what age is a young boar fit for service?

Answer.—If properly fed his virility and masculine characteristics should be sufficiently developed to allow light work at 9-10 months old.

Question.—Should a boar run continuously with the sows?

Answer.—No. The boar should be penned separately and the sows run with him during their period of oestrus, for the following reasons:—

1. It is undesirable to mate sows on the first period of oestrus following farrowing. (This occurs 3-4 days after farrowing.)

2. It is desirable to control the feeding of the boar and this cannot be done where he is running with mixed sows.

Question.—Over what period of time should a sow produce 3 litters?

Answer.—Twenty-four months.—This figure allows for young pigs to be 10 weeks old if necessary at weaning time, and allows for sows failing to conceive.

Question.—At what age is a boar considered to be too old for satisfactory work?

Answer.—This will largely depend on the treatment to which the boar is subject during his life. Under average conditions a boar should prove useful until he is 7-8 years old. At Muresk Agricultural College a boar rising 11 years is still working satisfactorily. Similar remarks apply to sows.

Question.—When buying a pig for breeding purposes is there any major point apart from purity of breed and suitability of type and conformation that should be looked for?

Answer.—Yes. It is desirable to know the litter production of the ancestors as far back as possible. A satisfactory sow during her lifetime should be able to average 8 pigs per litter. The number of pigs reared per litter is also worth investigating.

Question.—Can a boar's tusks be removed to prevent possible serious damage to other pigs and to make him less dangerous to handle?

Answer.—Yes. It is recommended that the tusks be clipped off at about gum level with a pair of bolt cutters or some similar instrument, as the occasion demands.

Question.—How could a large pig be secured to enable this operation to be performed?

Answer.—The pig is run into a race with a blind in front. A rail is placed behind the animal to restrict its movement. A running noose is then slipped over the upper jaw and the free end of rope pulled over a suitable rafter or beam until the rope is taut. No difficulty should then be experienced in handling the animal.

Question.—When is a sow's milk production at its maximum?

Answer.—About the end of the third week after farrowing and it declines thereafter. About this time suckers will take an interest in supplementary feed.

Question.—Is it necessary to provide supplementary feed for suckers?

Answer.—Yes, such feed should be provided in creep feeders and be available to piglets at 2-3 weeks old allowing approximately ¼-½ lb. per head per day and increasing to 1-1½ lb. at weaning or 8-10 weeks old. (Feed referred to = 90 parts crushed grain to 10 parts of meatmeal.) By this means suckers are brought to the maximum weight at weaning and being accustomed to dry feed they suffer less check when weaned. Weaning weight has a marked influence on subsequent growth.

Question.—How does barley compare with wheat for feeding pigs?

Answer.—Pigs develop more slowly on barley than on wheat, therefore a 50-50 mixture is recommended. This is especially significant when it is remembered that barley can produce under a variety of conditions (and other factors being equal) more weight of grain per inch of rainfall than any other cereal.

Question.—How much (a) Wheat, (b) Barley is required together with 10 per cent. meatmeal to develop weaners to baconers?

Answer.—(a) Experience in W.A. shows that approximately 6½ bushels of wheat is required to grow a weaner pig from 36-40 lb. to 180 lb., that is 140-144 lb. live weight gain.

(b) South Australian experiments show that approximately 8 bushels 25 lb. of barley was required to develop a weaner to a baconer, with 135 lb. live weight gain.

Question.—Is it an advantage to soak small grain, i.e., Wheat, Barley, Oats, etc., when feeding to pigs?

Answer.—Experiments show that soaking is unnecessary, but supplies of good water should always be available.

Question.—Is it an advantage to cook grain for pigs?

Answer.—There is no advantage to be gained from cooking. Twenty-six trials in America show an approximate loss of 10 per cent. in digestibility through cooking (potatoes benefit from cooking).

Question.—Is it an advantage to crush grain for pigs?

Answer.—Yes. Experiment at Muresk shows that in growing a pig from a 45 lb. weaner to a baconer approximately 200 lb. live weight, that 15s. 11d. more profit per pig was made where crushed grain was fed (comparison with whole grain). Crushing cost taken as 3d. per bushel.

Question.—If a mineral supplement is fed what is recommended?

Answer.—An adequate mineral supplement for wheat-fed pigs is 1 lb. of salt and 1 lb. finely ground limestone per 100 lb. of feed or 1¾ lb. of salt and ¾ lb. of finely ground limestone per 180 lb. bag of wheat. Green feed at the rate of ½ lb. per day per pig is an adequate Vitamin A supplement, but may be replaced by 5 per cent. of lucerne hay (1st quality) in the feed.

Question.—What is the value of culled sheep or rabbits as a substitute for meatmeal?

Answer.—Experience has shown that 3-4 boiled down cast for age and cull sheep approximately 50 lb. live weight (30-35 lb. dressed weight) supply sufficient protein for a pig from weaning (40 lb.) to baconer weight (200 lb.) live weight. Meatmeal required during the period would be about 30 lb., costing with meatmeal at £11 per ton about 3s. 4d., therefore each sheep is worth 10d. to 1s. 1d. as a substitute for meat meal, plus the market value of the skin. Sheep for this purpose would therefore have to be bought for a price of less than 1s. 6d., plus the expected return for the skin. 1 lb. of meat, therefore, will be approximately equal to 1-3 lb. of meatmeal. The value of rabbits can be worked out on this basis.

Question.—If 30 lb. of meatmeal is required to develop a 40 lb. weaner to a 200 lb. baconer, how is this allocated during this growth period?

Answer.—This 30 lb. allows for 0.19 lb. of meatmeal for each lb. of body weight increase. This allows 1 part of meatmeal to 9 parts of grain until 80 lb. live weight is reached and thereafter the meatmeal is reduced by 2½ per cent. as each additional 30 lb. of body weight is made. When 10 per cent. of meatmeal is fed in the ration from weaning to baconer weight approximately 58 lb. of meatmeal would be required per pig. This 10 per cent. with the grain is the standard ration used in all pig feeding trials in W.A.

Question.—Can linseed meal replace portion of the meatmeal fed to pigs?

Answer.—Linseed can replace without detriment 30 per cent. of the meatmeal in the ration.

Question.—Can more profitable returns be gained by feeding meatmeal in addition to grain?

Answer.—Yes. With the addition of 10 per cent. of meatmeal in a ration pigs grow faster and are more thrifty. Both wheat and barley have a relatively low protein content, are low in calcium and Vitamin A, and are therefore unsuitable as a sole feed for pigs.

Experiment in South Australia has shown that the amount of wheat without meatmeal required to produce 1 lb. of live weight gain in a pig (weaner to baconer) = 4.2 lb. Experiment at Muresk, W.A., shows the figure to be = 3.93 lb. The amount of wheat with 10 per cent. meatmeal required to produce 1 lb. of live weight gain = 2.5 lb. The extra efficiency obtained by supplementing grain with meatmeal is obvious. Moreover, the additional cost of the meatmeal cannot be claimed as a reason for not using same as the added cost is comparatively small and is more than repaid by results, e.g., adding 10 per cent. of meatmeal at £11 per ton to wheat at 3s. 6d. per bushel only increases the cost per 100 lb. of feed from 5s. 10d. to 6s. 2d., that is, by about 6 per cent., whilst up to 40 per cent. more pig meat may be obtained from the same amount of grain.

Question.—What percentage of live weight will a baconer dress?

Answer.—Experience has shown the actual dressed weight to be in the vicinity of 74-76 per cent. Buyers work on 66 2/3 per cent. to give them the dressed weight *value* at the factory.

Question.—In average weather how much water does a pig require?

Answer.—Approximately 12 lb. or 1 1/5 gallon for a pig weighing 100 lb. live weight. Much depends on the succulent nature of the food provided on determining the quantity.

Factors Influencing the Production of Clean Milk.

M. Cullity, Superintendent of Dairying.

During the years since the outbreak of the war there has been a tendency for the quality of butter to decline, and there is ample evidence that this is due in part to a tendency to relax the attention paid to details of production.

Quality in milk, whether intended for direct consumption or for manufacture is closely related to the number of micro-organisms which are present, and therefore cannot be obtained unless efforts to avoid contamination are intelligent and continuous.

The bacteriological condition of milk, however, is determined not only by the number but also the types of organisms which are present.

Bacteria are extremely small organisms which are invisible to the naked eye. They are everywhere, in the air, soil and water and in uncountable numbers. It is impossible to overestimate their importance. They carry out all sorts of work, often useful, *e g.*, nitrification in soils and in the ripening of cheese. A very important work is that of ridding us of dead organic matter by the processes of fermentation and decay. While much useful work can be attributed to their action, certain kinds are the cause of various diseases which afflict the animal and plant kingdoms.

These organisms require food for existence, and depending upon the conditions under which they are found, so their rate of development varies. Under optimum conditions, as will be shown later in the section dealing with cooling, the rate of multiplication is extremely rapid.

As it happens, milk is an extremely good medium for the growth of certain kinds of bacteria, and while all of these may not be harmful to humans, their presence has a definite influence on keeping quality.

Barkworth, Mattick, Taylor and Stenhouse Williams at the Reading Institute demonstrated that according as there was a rise in bacteriological content, so there was a steady fall in the length of time the milk would keep sweet. This supports the usual measure of practice; the housewife generally judging the quality of the milk by observing whether the milk will keep for a reasonable period or whether it goes "off" or sours quickly.

Further, it was shown that when organisms of the Coli type were present, the deleterious effect on keeping quality was much more severe. Various types of pure organisms are intestinal and gain access to the milk directly or indirectly from dung.

Therefore it is obvious that if milk is to keep for any reasonable period, it must be produced and treated under conditions where the numbers of bacteria gaining access and developing, are restricted—that is, milk of "low-count" must be produced.

It has been repeatedly shown that the factors governing the production of milk of low count may be grouped under a small number of headings. The results obtained from Clean Milk Competitions in Wales reported by S. B. Thomas in the Welsh "Journal of Agriculture" are typical.[1] He states that a survey of the methods used show that the four chief factors in the production of clean milk are as follow:—

(a) Sterilisation of the utensils by steam instead of scalding water.

(b) Attention to details during milking.

(c) Cooling to as low a temperature as possible immediately after milking.

(d) The personal factor.

The more common aspects affecting the quality of the product may be treated as under:—

Atmosphere.

The atmosphere during the winter months is not a very serious contaminating feature, except where dry, dusty feeds are fed during milking or where the floor of the shed has been swept while dry prior to the commencement of milking.

In the summer months, however, the risk of contamination is greatly increased, inasmuch as more dust is usually present in the air. The movement of the cattle in the yards creates this in large amounts, which finds its way into the milking sheds.

To reduce the possibility of contamination, it is advisable to design the buildings in such a way that a minimum of dust enters. The movements of the cows should also be studied, so that unnecessary driving is obviated.

While the sum total of the effect of atmosphere in our climate is usually not so severe as some other contaminating features, many of the types of bacteria that enter milk in this way are particularly objectionable and undesirable

The Health of the Herd.

This has little or no influence on the total bacteriological count unless actual disease of the udder is present. In these cases, however, usually other abnormalities are present which will render the milk unfit for use.

The effect of the presence of such specific disease organisms as that responsible for tuberculosis and contagious abortion is beyond the scope of this article.

The effect of mammitis in increasing the numbers of organisms is well known by the following results from Wales:—

Cow.	Normal Quarter.	Inflamed Quarter.
Nancy	55	11,200
Sybil	1,450	156,000

The possibility of serious trouble with contagious mammitis is more likely where a milking machine is in use. The starting of the cows by drawing off a little fore milk is necessary to enable the operator to note whether the udder is in good order and to prepare the teats for the fixing of the teat cups.

The rejection of the fore milk should never be on to the floor of the shed, but into a bucket to be kept separate from the bulk.

The Coat of the Animal.

Contamination from this factor involves material falling into the milk during the milking process. This dirt includes manure, soil, hairs, etc., carrying organisms in considerable numbers, usually in groups which become broken up and spread throughout the milk. The greater portion of the dirt present in milk usually gains entrance from the body of the animal during milking. This may be minimised by keeping the coats in good order and by wiping the flanks and udder with a damp cloth prior to milking. The necessity for cleanliness of the teats is obvious.

Stocking of the New York Experiment Station obtained the following results, which indicate the effect of care in cleaning the cow.

Contamination of Milk by the Dirt from the Udder and Flank.

	Bacteria per C.C.		
	Total.	Acid Producing.	Liquefying.
Udder and Flank not wiped ..	7,058	3,554	81
Udder and Flank wiped	716	185	47
Decrease due to wiping ..	6,342	3,369	34

Milking.

The rejection of the first jets of milk from each teat means the rejection of that milk containing by far the greatest number of bacteria. While this is necessary in order to attain a high standard of production, it does seem absurd to see milkers very carefully do this and then more than nullify the good effect by some practice which results in seeding the milk with a still greater number of bacteria.

The table under gives some idea of the comparative bacteriological contents of fore milk, mid milk and strippings.[2]

Cow.	Fore Milk.	Mid. Milk.	Strippings.
Berriers II.	3,040	304	574
Laura	310	13	455
Nancy	11,520	1,650	760
Betsy	3,780	376	210
Mabel	20,800	810	788
Jean	1,680	709	125
Average, 18 samples	4,605	1,329	662

That milk drawn with clean dry hands is cleaner than milk obtained by hands wet or greased with petroleum jelly or other substance has been definitely shown by Boyes and McClement of the National Institute, Reading. The results of the trials showed that no B. Coli was present in milk drawn with dry hands, while that drawn with greased hands was slightly better than when wet milking was practised (both systems, however, showing B. Coli).

The advantage of dry milking was emphasised further when the bacteriological counts were considered, the dry hand method being easily the superior, while the greased hand method was considerably better than the wet hand method.

The following table shows the results:—

Bacteriological Count.

Method of Milking.	Number of Samples.	Bacteriological Count—Number of Samples.			
		0-1,000.	1,001-10,000.	10,001-30,000.	Over 30,000.
Dry	30	22	6	..	2
Wet	30	3	16	4	7
Greasy ..	30	15	10	2	3

The samples were then tested for sediment and the results tabulated, again showing the milks from best to worst in the same order, that is, dry, greasy, wet.

It is particularly necessary, therefore, to take exceptional care in preparing the cow and in the actual milking. Long hairs should be clipped from the udder, the teats must be properly cleansed and dried with clean cloths and water containing a little disinfectant, preferably a little Condy's crystal. The milker's hands must be kept in a clean condition and an ample supply of water should be on hand for washing purposes.

Milking Machines.

Machines have been the subject of several investigations, all of which tend to show the liability to the production of milk of high count (or low keeping quality) in the hands of any but very careful operators. It, however, has been abundantly proved that, with careful operation, milk of low count can be produced. This is possible only where strict attention is paid to all details and efficient sterilisation is carried out. The teat cups and rubbers are usually a serious source of contamination, as has been pointed out previously.

The vacuum system—usually the most neglected part of the machine—is often responsible for the seeding of large numbers of bacteria into the milk, even where the rest of the equipment may be in faultless condition. Mattick and Proctor[3] showed definitely that the vacuum system was causing considerable contamination, and they suggested improvements which were incorporated in later machines. They also showed that the milking units and their rubber components may be successfully sterilised by steam without seriously shortening the life of the rubber parts. The United States Department of Agriculture also states that the temperatures used in sterilising rubber equipment have not been more detrimental than the other methods of sterilisation.

In bucket type machines, the buckets, rubber parts, and vacuum system comprise nearly the whole of the contaminating influences. In the releaser type of machine, however, there is in addition the long overhead milk pipe, the connecting down-pipes and the releaser apparatus. This all means additional surface over which the milk must pass and which must be sterilised before satisfactory results can be expected.

The most satisfactory method of washing machines already has been described but may be recapitulated here.[4]

1. Before milking, draw cold water through all milk tubes and the releaser so as to prevent the adhesion of milk to the pipes, etc.

2. Immediately after milking wash all dirt off the outside of the teat-cups and rubbers, then draw through each set of teat-cups sufficient cold (or preferably warm) water to flush out the milk system. When drawing the water through the set farthest from the releaser, insert a ball of horse hair in the end of the milk pipe to cause it to travel through to the releaser with the water.

3. Next draw through *each set* of teat-cups *not less than one gallon of boiling water* to which caustic soda has been added at the rate of *not less than* 1 *to* 1½ *teaspoonful per* 4 *gallons of boiling water.* Distribute the solution as evenly as possible through each set of teat-cups.

4. Immediately follow by flushing out the caustic soda solution with 2 gallons of hot water or 1 gallon of *boiling water* for each set of teat-cups; the flushing with boiling water helps to dry the rubbers and leave the milk system dry and sweet.

5. Then remove or open the plug or flap from the releaser pipe to allow of free circulation of air.

6. Next *clean the vacuum system* in the same manner as the milk system by drawing through first the caustic soda solution and next the boiling water which has been circulated through the milk system. *Pay particular attention to the cleaning of the pipe connecting the releaser to the vacuum tank,* by flooding the releaser to cause the water to travel through to the vacuum tank. This is important.

7. The engine can now be stopped. *Disconnect the two long rubbers* from down-pipe and teat-cups and hang in a clean, airy place out of the sun.

8. Next disconnect the releaser, wash, rinse, and place in a clean dry sunny place, then disconnect the top or bottom half of the vacuum tank and treat in a similar manner. *To be successful these operations must be carried out daily.* This does not dispense with the necessity of dismantling the machine as often as possible so that points and crevices may be examined and treated.

The effect of using boiling water throughout the machine before milking and then cooling the machine is very efficient in reducing the count (see later, Sterilisation before use).

Washing of Utensils.

In washing utensils there are three main processes which may be summarised as under:—

1. Removal of milk film by rinsing with cold or luke warm water. Should this be neglected and hot water used directly on this film, there will result a greasiness of the parts with the ultimate formation of a scum or milk stone.

2. Cleansing in warm water containing a little soda or other cleansing agent using brushes.

3. Sterilisation.—Delayed washing, though usually thought to have little effect on the ultimate count, generally exerts a very direct influence due to the greater development of bacteria on the vessels before washing.

The trials referred to above also gave results showing the average count in milk—where utensils were washed directly after milking—to be 666.520 per cubic centimetre, while, where washing was delayed for eight hours the count was 1,677,000 per cubic centimetre.

Sterilisation of Utensils.

The condition of the utensils exerts the greatest single influence on the bacteriological content of the milk. The effect of improperly washed utensils is too obvious to need emphasis. Where washing is carried out thoroughly and sterilisation neglected, there is still a serious contamination. Prolonged heating with steam will not render utensils perfectly sterile, and it is certain that heating under the conditions usually carried out does not do the work required as effectively as the operator wishes.

Efficient sterilisation on a farm could only be obtained by the installation of a steaming compartment. This is beyond the resources of producers at the moment. But yet a simple effective method is that suggested by Proctor and Hay, of the National Institute of Reading, and previously described in this Journal. This in essence is the furnishing of a small tank in which the smaller equipment may be placed and the whole put in position over a steam pipe from an ordinary boiler or copper. This system is not beyond the reach of many of the producers. The most common equipment, however, is the copper alone. In the great majority of cases this can be utilised more efficiently than is actually the case. To obtain the greatest effect *the water must be boiling* and the equipment placed therein for at least 15 to 20 minutes. Unfortunately, however, this procedure is not common, and what one usually sees is the splashing of hot water (usually not more than 140 degrees or 150 degrees Fah.) over the equipment. This is not effective, and an extension of the time of exposure to heat must be made to achieve more efficient sterilisation.

Exposure for one minute to a temperature of 200 degrees Fah. is as effective as 20 to 30 minutes exposure to a temperature of 140 degrees Fah. So, naturally, if boiling water is not available, the period of immersion must be lengthened considerably. A good plan is to place all parts, sufficiently small, in the copper, and to allow them to remain there for some time.

Sterilisation of Milking Machine.

It is particularly necessary that sterilisation of the milking machine be as complete as possible. Boiling water may be used for rinsing out the pipe lines, etc., but its effect is nullified if the temperature of the pipes, etc., is such that the water is cooled to a point where its work is ineffective. Care should be exercised to see that all parts of the machine are heated to as high a temperature as is possible with boiling water or steam. A very important effect is that a self-drying degree of heat is imparted, enabling the parts to drive off all moisture, thus rendering the growth of bacteria a slower process than where moisture is present.

The following table shows the comparative effects of steam and boiling water as sterilising mediums, compared with effects where utensils were washed, but not sterilised.

Sterilisation of Utensils.	No. of Farms.	No. of Milk Samples.	Average No. of Bacteria c.c.	Per cent. Samples in which Coliform Organisms detected.	Average keeping quality (days).
Efficient steam sterilisation	22	157	20,340	29	3·75
Efficient use of boiling water for sterilisation	44	308	61,000	48	3·48
Utensils washed, but not sterilised	21	158	467,000	94	1·90
Total	87	623			

The decline in keeping quality where no sterilisation was carried out is most striking.

Effect of Sterilisation Before Use.

After washing, utensils are usually left for several hours before the next milking, and in that time a considerable increase in the number of bacteria occurs. Where the vessels remain wet for any reason after scalding, the growth of bacteria is more rapid than where the utensils dry out quickly.

Where a second scalding is carried out again before use, the destruction of most of the bacteria occurs, and a very improved result is obtained. This fact was demonstrated in trials carried out by the Public Health Department for the Royal Commission on the Whole Milk Supply in Perth in 1925.

Seven samples taken after passing over the cooler into a drum, after mere "cleaning" of the reservoir cooler and drums, gave the following counts:—

Total 45,000. Coli 4.

Eight samples taken after passing over the same utensils after they had been dipped in boiling water, gave the following results:—

Total 2,045. Coli 2.

Clemmer of the United States Department of Agriculture, obtained the following actual results:—

Influence of Sterile Utensils on the Bacterial Content of Milk.

	Utensils not Sterile.		Utensils Sterile.	
	Number of Samples.	Average No. Bacteria per c.c.	Number of Samples.	Average No. Bacteria per c.c.
Open pail	26	497,653	36	22,677
Small top pail ..	28	368,214	36	17,027

A similar result with milking machines was obtained by Leitch.[5]

	Sample A.	Sample B.	Sample C.
Unit treated with hot water before milking	8,100	7,900	19,500
Unit untreated with hot water before milking	1,600,000	316,000	515,000

The results indicate that the sterilisation of the utensils immediately before use in many cases made all the difference between the production of high and low count milk.

Cooling.

The necessity for cooling the milk after it has been drawn cannot be over emphasised. After the milk has been obtained this is the most important factor in restraining the development of bacteria.

The following table shows clearly the effect of temperature upon the rapidity of multiplication of bacteria and on keeping quality:—

No. of Bacteria c.c. at outset.	In 12 hours at 50 deg.	In 12 hours at 70 deg.	In 50 hours at 50 deg.	In 50 hours at 70 deg.	No. of hours before Curdling at 50 deg.	No. of hours before Curdling at 70 deg.
46,000	39,000	249,500	150,000	542,000,000	190	56
47,000	44,800	360,000	127,500	792,000,000 (36 hours)	289	36
50,000	35,000	800,000	160,000	2,560,000.000 (42 hours)	172	42

(Bulletin 26, Storrs Sta., Conn.).

Various types of bacteria have different temperatures at which they develop most rapidly. At the temperature at which the milk comes from the cow development of Coliform and other gas producing organisms proceeds at their maximum rate. After the next process on the ordinary farm, the water cooling, the tempera-

ture is usually reduced to the vicinity of 70°F. (summer) at which temperature a different type of bacteria thrives, the lactic acid producing group, which are not considered harmful to health, but which if allowed to develop, reduce the time in which the milk will remain sweet; they cause souring. To prevent this from proceeding, where the milk has to be kept, it is necessary to reduce the temperature to a lower point, 40-50°F., where bacterial growth is comparatively slow. This can be achieved by the use of the brine cooler.

The cooling of milk to a low temperature immediately after milking is necessary in order to safeguard keeping quality. This effect may be nullified, however, if the cooler is allowed to be operated without first having been scalded. The investigations carried out by the Public Health Department in 1925 demonstrated the increase in the numbers of bacteria occurring in the passage of the milk over the cooler.

	Before Cooler.	After Cooler.
Sample 1	3,120	132,000
„ 2	1,800	8,000
„ 3	7,110	105,000
Average	4,010	81,666

Water Coolers are most effectively scalded by placing in a tub or copper of boiling water. The usual method of allowing hot water to run over the surface is often futile.

Brine Coolers are difficult to deal with under farm conditions as they are often too large to be placed in the usual size of boiling apparatus. The ordinary method of scalding seen is the running of a quantity of hot water over the cooler, or the throwing of buckets full of water against the surface. When one considers that the usual brine cooler is fitted in such a way that the cold brine is still inside the pipes to be sterilised, it can readily be understood that the ordinary attempts at scalding are farcical. Actually the cold brine cools the heating medium before any scalding effect is obtained. That the brine cooler, though clean visibly, can be a serious source of contamination has been shown recently in this State during investigatory work carried out by this Department. It was demonstrated that a small brine cooler, although bright and clean on inspection, was actually seeding the milk with B. Coli. Actual sterilisation of this piece of equipment had never been carried out.

The provision of a by-pass or some system whereby the brine can be returned to the storage tank would facilitate scalding of the cooler itself.

Strainers of various types are in use and in many cases are doing damage to milk. The all-metal strainer is only efficient in catching the larger particles, and there is always the possibility of its gumming up, particularly at the edge. Sterilisation of these types can be achieved only by a period of boiling.

The cloth strainer should never under any circumstances be used twice without boiling and drying in the direct rays of the sun. Where the cloth is allowed to dry, as is usually the case, thrown over the cooler, or on a small line in the dairy, drying is slow and the bacterial multiplication proceeds extremely fast. The result of this is that the cloth becomes a very serious contaminating medium when again used.

The most effective type of strainer is that which uses a wad of cotton wool between two metal perforated discs. The wool is used once only and then discarded, a fresh wad being put in place at each milking. This type of strainer removes practically all visible dirt which finds its way into the milk.

Storage.

After the milk has been cooled it is necessary to provide a storage room where the temperature can be kept constant at a low point so as to prevent any great muliplication of organisms in the milk.

Transportation.

Precautions are necessary here again on the same principles as the preceding section. The temperature of the milk has to be kept at a low point. This can be achieved by cooling to a low temperature, shortening the period of transportation, and using precautions to prevent heat reaching the vessels in transit. Thomas and Lewis showed that a rise of 10°F. in transit decreased the keeping quality by one day.[6]

Personal Factor.

That there is a considerable difference between the results obtained by various men working under exactly similar conditions will be accepted. Actually the personal factor may be regarded as the crux of clean milk production, as unless keenness and a desire to produce a good article is evident, the tendency is to neglect the details which means the difference between efficiency and inefficiency. Details overlooked in milking, in washing and sterilisation of utensils, in cooling, etc., nullify any advantage that may be gained by working in good premises with good equipment. A good operator in poor surroundings will usually produce a cleaner milk than a poor operator with good equipment.

A special study was made of the personal factor as applied to the production of milk with a low count on small farms.[6] *The buildings and equipment were generally poor, but personal efficiency and care in the methods of production counteracted this handicap.*

That an incentive to produce clean milk by way of paying a premium has a considerable effect in concentrating attention on the details which govern low counts has been recorded by North.[7]

Influence of Various Factors on Bacterial Content of Milk.

Date.	Bacteria per c.c.	Remarks.
December 26th	5,500,000	Tests begun.
December 31st	3,000,000	
January 6th	1,000,000	
January 13th	500,000	Weather freezing.
January 29th	800,000	
February 12th	900,000	
March 5th	700,000	
March 12th	250,000	Small top pails.
March 19th	250,000	
March 26th	80,000	Pails and can sterilised.
April 2nd	1,000,000	
April 9th	70,000	
April 16th	35,000	Premium paid for low count.

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The Pear Slug.

C. F. H. Jenkins, Government Entomologist.

THE original home of the pear slug (*Caliroa limacina* Retz.) is believed to be Europe, but it has spread to many fruit-growing countries of the world, and is well established in Australia, where suitable host plants are grown, that is, in those parts which have a cool temperate climate.

GENERAL DESCRIPTION.

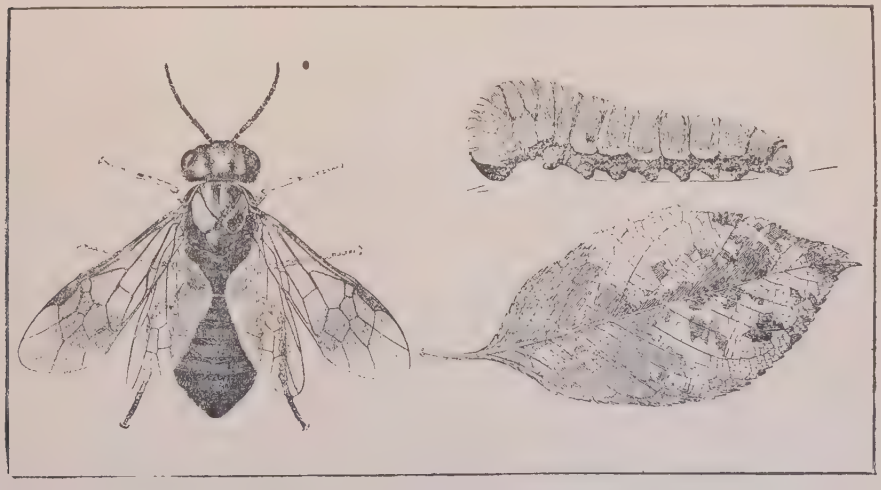
The adult insect is really a species of wasp, although the members of the group to which it belongs are popularly known as saw flies. The name saw fly is derived from the fact that the females possess a saw-like ovipositor or egg-laying tube with which they are able to slit the leaf tissues for the purpose of depositing their oval flattened eggs. As will be seen from the illustration the adult pear slug, like all bees and wasps, possesses two pairs of wings. True flies, on the other hand, have but a single pair, so that the term saw wasp would be actually a more accurate appellation than saw fly.

It is the grub or "slug" stage of the insect which is most commonly seen, but the parent insect is a shiny black wasp about ¼ inch in length with clear membranous wings.

LIFE HISTORY AND HABITS.

The eggs are laid beneath the upper epidermis of the leaf, and are sometimes apparent as slight blister-like swellings. The hatching period is about 10 to 14 days, after which the tiny slug-like larvae appear. They are slightly broader at the head end than the tail, and are provided with three pairs of short legs. The term "slug" is most appropriate, for the insects are enveloped in a dark slimy material which gives them a glistening slug-like appearance.

The life history of the insect has not been accurately worked out in Western Australia, but in Tasmania it has been shown that the first adults commence egg-laying about November, and that the adults of the second generation are active about January.



Adult saw fly; "slug" with slime removed and leaf showing typical damage. (N.S.W. Agric. Gaz.)

The "slugs" feed almost entirely on the upper surface of the leaves and complete their growth in from three to four weeks. They then fall to the ground where they form a small oval cocoon or chrysalis of parchment-like material covered with soil particles. The pupal stage lasts a fortnight or so and then the adults of the second generation appear. Male saw flies are very rare, and it is worthy of note that the females are able to lay fertile eggs without previous fertilisation. "Slugs" of the second generation feed on through the late summer and then enter the soil, where they form small earthen cells about three inches below the surface in which to pass the winter. With the advent of spring these over-wintering "slugs" pupate and give rise to the first spring generation of saw flies.

It may be mentioned that if squashed or handled the "slugs" emit a distinctly unpleasant odour.

TYPE OF INJURY.

The "slugs" have true biting mouth parts like caterpillars, but do not devour the entire leaf issue when feeding. They eat away the upper surface of the leaf and the underlying green cells, so that the entire skeleton of the foliage is left uninjured. This skeletonisation of the foliage is sometimes so severe that trees look as if they have been swept by fire. The infestation is usually worse at the summit of the tree and so is often disregarded until it has gained a good foothold.

HOST PLANTS.

As the name pear slug implies, the pear is one of the chief host plants of this insect, and is definitely so as far as this State is concerned, for although the name cherry slug has been appropriately applied in some countries the cherry is but rarely grown in local orchards. Plums are not infrequently attacked, and almonds, walnuts, quinces and the hawthorn have all been listed as harbouring the pest.

CONTROL.

The pear slug is a very easy pest to control and rarely gives any trouble where spray treatments with either arsenate of lead or nicotine are given in the spring for other insects.

If the "slug" alone is to be dealt with the following formulae will be found effective:—

I. Arsenate of lead powder, 1 lb.; water, 50 gallons.

II. Nicotine sulphate, ¾ pint; water, 100 gallons; soap, 3 lb.

The latter spray is recommended if it is necessary to treat trees in the late summer when fruit is maturing and when it is undesirable to have deposits of arsenate of lead on the ripening crop.

So vulnerable is the pear slug to various treatments that mild outbreaks can be controlled simply by dusting the foliage with soot, slaked lime or even road dust. Such finely divided substances cling to the slimy "slugs" and cause their destruction.

LITERATURE.

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Evans, 1938: *Tasmanian Journal of Agriculture*, Vol. IX., p. 130.

ERRATUM.

A misprint shows in line 20, page 258, of Vol. XXI. (Sept., 1944). The production of "Camden Circe" should read 9.265 lb. milk, average test 6.28 per cent., 582.55 lb. butter-fat.

Wheat Variety Trials.

I. Thomas, Superintendent of Wheat Farming, A. J. Millington, Plant Geneticist.

WHEAT Variety Trials were conducted during 1945 on all five wheat belt research stations and on two farms in the northern agricultural areas. On the research stations, the varieties are grouped as either mid-season or early maturing and sown accordingly in early and late May respectively.

The principal rainfall recordings were towards the end of May, July and August. The relatively delayed opening of the season and the absence of rains after late August, provided a severe test of varietal resistance to drought.

The effect of incidence of rainfall is important as is shown by the yield of 29 bushels per acre given by Bungulla at Avondale on an actual growing period rainfall of only 813 points. This is slightly less than two-thirds of the average for this period.

Experimental Design.

The layout of the Variety Trials on the research stations was changed in 1944 from the "three plot system" to a randomised block type.

In the three plot system each variety is grown adjacent to a control variety and the average yield is expressed as a percentage of the control. The most prolific variety will give the highest percentage of the control.

The randomised block layout has several advantages over the "three plot system." Firstly, any two varieties can be compared directly and not indirectly through the control and secondly an estimate is obtained of the difference which must be obtained between varietal yields before it can have practical significance.

If variety A outyields B by two bushels per acre, and the difference required for "significance" is one and one-half bushels, then A is regarded as yielding significantly more than B.

On the other hand if the difference in yield between A and B is only one bushel per acre, the conclusion is that there is no significant difference between their yields.

It is also permissible with the randomised block design to use the percentage yields to obtain the difference for significance. Where A outyields B by 15 per cent. and the "difference for significance" is 10 per cent. of B, A is regarded as significantly outyielding B. If the difference is 5 per cent. which is less than the difference required for significance, the two are regarded as yielding equally well.

The "difference for significance" will vary from one experiment to another and is calculated separately for each.

The reduction in the number of control plots when the randomised layout is used enables more varieties to be tested on a given area.

Early Maturing Varieties.

Rust Resistant.—Five rust resistant varieties were tested but their yields were on the whole disappointing. Three of the varieties tested, M. 60, M. 61 and M. 62, were bred at the Merredin Research Station and are early to early mid-season

maturing. They are from a (Sword x Kenya) cross and are resistant to the new Eureka attacking rust strain which has appeared in New South Wales, and also to the standard rust race 34 occurring in W.A.

Charter.—Released as a variety in 1944 by the New South Wales Department of Agriculture, Charter is derived from a (Kenya x Gular) cross. It is a tall growing wheat, resistant to the Eureka attacking rust strain. The grain is less subject to mottling than is that of Eureka and it is reputed to yield flour of premium strength. Charter will certainly be of value as a hay variety and the results of the 1944 trials indicate that it is at least equal in yielding capacity to the other resistant varieties.

Rust Susceptible Varieties.

Bungulla.—This is consistently the most prolific early maturing variety under test and for late May planting it has outyielded Bencubbin over a four-year period at all Stations except Merredin where the yield differences are not significant.

Bungulla should be restricted to late May and early June plantings to avoid excessive growth and subsequent lodging.

Koorda.—The most satisfactory yields recorded by this variety have been on light land where its excellent straw strength considerably reduces pre-harvest losses. Over a four-year period, Koorda has outyielded Bencubbin and Merredin, which it is replacing, in late May plantings at the Wongan Hills Research Station.

Mid-Season Varieties.

Rust Resistant.—Eureka has been under test at the Chapman Research Station for four seasons, one of which, 1943, was notable for a moderate rust epidemic. Over this period it has yielded 5 per cent. more grain than the Nabawa control; Bencubbin during the same period has produced 27 per cent. more grain than Nabawa.

Eureka is a stout strawed, brown glumed variety which yields well under conditions of high fertility and rainfall. The grain usually mottles badly.

Rust Susceptible Varieties.

Bencubbin has consistently outyielded other mid-season varieties at all Stations and showed to advantage during 1944 when no spring rains occurred.

Kondut is less susceptible to rust than Nabawa and Bencubbin and over a four-year period it has outyielded the former by 18 per cent., at the Chapman Research Station. This included a moderate rust epidemic in 1943.

W. 19 is a selection from Sword made at the Wongan Hills Research Station. It is late mid-season maturing and therefore, in view of the lack of finishing rains the yields recorded must be regarded as satisfactory. W. 19 is notable for its excellent flour strength.

Nabawa was a notable variety in the development of the drier regions of the Australian wheat belt immediately after World War 1 and during the expansion period 1926-35.

Nabawa was developed at the Chapman Research Station and released in 1915, primarily because of its resistance to rust. The appearance in Australia in 1925 of race 34 reduced its value for rust liable districts, but Nabawa was the first widely grown flag smut resistant variety. From 1932-35 it was the most

extensively grown variety in Australia, and from about 1920 to 1934 in Western Australia. It was then replaced by its derivative Bencubbin, which is in most districts 12-14 per cent. more prolific.

Nabawa has been used extensively by Australian plant breeders and it ranks with Federation as an outstanding product of Australian wheatbreeding.

ACKNOWLEDGMENTS.

The authors gratefully acknowledge the assistance of the farm managers and Mr. N. Davenport, Senior Agricultural Adviser at Geraldton in conducting the trials and supplying the yield data.

Avondale Research Station—Mr. W. A. Human.

Chapman Research Station—Mr. F. Gishubl.

Merredin Research Station—Mr. J. H. Langfield.

Salmon Gums Research Station—Mr. F. A. Newman.

Wongan Hills Research Station—Mr. D. R. Bateman.

Thanks are due also to the Deputy Conservator of Forests, Mr. T. N. Stoate, for the statistical analysis of the results.

RESEARCH STATION RAINFALL.

Station.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Tota
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Merredin—														
1944	21	....	25	15	263	75	287	172	47	6	850	....	24	935
Average	47	60	100	92	134	188	178	149	82	80	811	42	62	1,214
Avondale—														
1944	2	....	8	25	214	107	271	202	21	....	813	53	1	906
Average	29	44	116	84	223	296	308	238	111	89	1,290	43	37	1,619
Salmon Gums—														
1944	18	1	11	89	275	44	142	120	57	51	689	29	56	893
Average	99	78	163	92	126	143	144	156	90	121	780	95	83	1,391
Wongan Hills—														
1944	3	....	21	19	249	131	374	193	40	14	1,001	7	40	1,091
Average	40	52	106	91	187	250	247	196	91	75	1,050	42	40	1,429
Chapman—														
1944	....	....	36	52	250	226	542	203	46	....	1,267	29	42	1,426
Average	29	39	70	74	234	419	383	266	150	89	1,553	35	26	1,817

FARMERS' FIELD TRIAL—GERALDTON AREA.

Variety.	K. Williams, Northampton.			G. Chambers, Mendel.	
	Yield.	Per cent. Nabawa Control.		Yield.	Per cent. Bencubbin Control.
		1944.	Average, 1942–44.		
	bus. lbs.			bus. lbs.	
M. 60 (Sword x Kenya)	7 39	109	....	17 51	84
Eureka II.	8 5	115	141	16 23	77
Merredin	....	....	....	16 32	78
Koorda	....	....	....	16 53	80
Kondut	8 51	132	111	....	....
Bencubbin	9 25	140	108	21 10	100

RESEARCH STATION VARIETY TRIALS, 1944.

Variety.	Rust Reaction.	Avondale Research Station.			Wongan Hills Research Station.			Merredin Research Station.			Chapman Research Station.			Salmon Gums Research Station.		
		1944 Yield.	% of Control.		1944 Yield.	% of Control.		1944 Yield.	% of Control.		1944 Yield.	% of Control.		1944 Yield.	% of Control.	
			1944.	Ave.		1944	Ave.		1944	Ave.		1944	Ave.		1944	Ave.
EARLY MATURING:		bus. lb.			bus. lb.			bus. lb.			bus. lb.			bus. lb.		
M.60	Resistant	24 32	93	98‖	9 18	103	127¶	11 18	76	82¶	13 28	105	118¶	14 34	103	....
M.61	,,	....	....	....	....	....	....	9 49	66	....	13 42	107	....	12 19	88	....
M.62	,,	....	....	....	9 10	102	....	....	....	....	15 2	118	....	14 2	100	....
Charter	,,	....	....	....	8 4	90	....	12 19	83	....	15 18	120	....	....	....	....
Bungulla	Susceptible	28 43	109	106§	11 42	130	116§	14 54	100	97§	17 1	133	121‡	18 18	130	113§
Koorda	,,	24 56	94	90§	11 24	127	105§	11 33	78	81§	12 43	99	108†	13 36	97	110§
Merredin	,,	27 44	105	97§	9 16	103	92§	....	....	....	12 40	99	100*	....	....	....
Bencubbin (Control)	,,	26 27	100	100	9 0	100	100	14 50	100	100	....	....	....	....	....	....
Nabawa (Varieties)	,,	....	....	....	....	....	....	....	....	....	12 48	100	100	14 5	100	100
Diff. for Significance (P. = ·05)		2 16	9	....	1 49	20	....	1 32	10	....	2 17	18	....	1 46	12	....
MID-SEASON MATURING:																
W.19 (Sword Sel)	Mod. Susceptible	16 24	91	....	....	....	....	8 18	70	....	7 39	128	....	18 34	116	....
Kondut	,,	15 23	85	96§	....	....	....	6 32	55	87	7 49	131	111†	14 2	87	96§
Eureka	Resistant	12 48	71	....	....	....	....	7 54	67	77	5 22	90	105§	13 52	86	95**
Bencubbin (Control)	Susceptible	18 0	100	....	....	....	....	11 49	100	100	11 17	188	119*	19 12	120	112
Nabawa (Varieties)	,,	....	....	....	....	....	....	....	....	....	5 58	100	100	16 3	100	100
Diff. for Significance (P. = ·05)		1 45	10	....	....	....	....	1 8	10	....	1 0	17	....	1 54	12	....

* 1937–44, † 1938–44, ‡ 1939–44, § 1941–44, ‖ 1942–44, ¶ 1943–44, ** 1942 and 1944.

Notes on Dairy Topics.

THE following extracts culled from reports of District Dairying Officers are published with the hope that they may be of interest to dairy farmers by keeping them advised of developments in these districts.

"Pig-meat production still continues to rise comparatively. During February, 398 pigs were sold over the scales at Boyanup as against 207 in February, 1944. At auction 134 baconers compared to 103 in February, 1944, and 168 weaners, slips and stores as against 60 in February, 1944.

"The greater numbers of young pigs augers well for baconer supplies in the following months. Feeders still complain of the difficulty in securing feed wheat in a reasonable span of time—eight weeks' delay after ordering is common."—(R. A. Paul, Bunbury.)

"An increased number of farmers have already placed orders for milking machines for installation early in the year and such items as windmills, gristers, cultivating implements, etc., are being acquired to a greater extent than for some years. In fact mechanisation generally has been coming in for a good deal of attention, more from the point of view of the individual, than from the machinery pool idea."—(A. L. Hamilton, Margaret River.)

"The clearing of land with a bulldozer has been demonstrated in the Kendenup district this month and farmers and observers are very favourably impressed by the results. It is quite evident that this type of machine offers great possibilities for the future clearing of land for agricultural purposes. A hundred-acre paddock of trees measuring 4 to 15 inches in diameter pushed out by the roots in three weeks by one man and a machine is a feat little dreamed of by older settlers. There are still men on the land who say regarding modern labour-saving devices, 'What was good enough for my Dad is good enough for me,' but when it comes to clearing, the bulldozer appears to win the support of all.

"Numerous inquiries and applications to hire the machine indicate the favourable impression on farmers. A private contractor has commenced negotiations to purchase one for operation in the district and if this is obtained it can be kept working continuously on clearing and dam sinking for several years.

"It can be said that no less than a thousand people visited the site to see the machine working, coming from as far as Darkan, Kojonup, Gnowangerup, Tambellup, Broomehill, Borden and Cranbrook. The site enabled the machine to operate part of the time on the main Albany highway roadside, consequently it was convenient for farmers from far inland travelling to the coast for their vacation."—(C. W. Tobin, Albany.)

"Farm Targets.—Eighteen farmers were contacted during the month. The majority are in a position to increase production and intend doing so. One big farmer intends going in for grazing due to the shortage of manpower, whilst two others are limited by the amount of fertiliser received. Prospects look bright for an increased number of dairy cows being milked in the coming season."—(R. A. Paul, Bunbury.)

"Production of butter-fat over the whole district is up 7 per cent. on January, 1944; the bulk of this came from the Northcliffe district—Bridgetown and surrounding districts are actually down on last season's figures possibly through the dry spring and the effects of superphosphate rationing, which is now showing up. Fruit picking has now begun and an excellent crop is anticipated. This factor has a bearing on the length of the season during which dairying is carried on, and with the restricted labour, numbers of cows were dried off earlier than usual. Manufacture has dropped considerably and cream pick-ups have been reduced accordingly; this is not in the best interest of quality, but the small amount of cream available makes it uneconomical to give the service necessary for a high class article."—(J. T. McNally, Manjimup.)

"Pig production shows a substantial increase on last year. At three sales conducted between the 16th and 23rd of last month 429 baconers were sold whereas the number for the same period of 1944 was 357. Over the scales at another centre 278 baconers were purchased, being an increase of 93 on the best January sale of last year. The top price of 142s. was secured at auction."—(R. A. Paul, Bunbury.)

"Cream quality as seen during the month has been low: a large proportion of these creams are only 'borderline' first grade; ferment, age and high temperature are responsible for considerable quantities of second grade. The dried inland areas, where dairying is mainly a side-line to other agricultural pursuits, are the source of many low-grade creams, due principally to inadequate premises, fluctuating temperatures with a high maximum, and infrequent deliveries."—(B. Williams, Fremantle.)

"The problem of water supply for stock and other purposes has not been so acute this year, no doubt due to the good falls of rain during the latter part of 1944. Many farmers have installed, and are still installing, windmills to reduce further the inconvenience of carting and hand pumping of water from wells. This fact may be reckoned a distinct advantage in connection with increased production, for there is an ever-present tendency on the part of the farmer to curtail the amount of stock drinking water in instances where the tedious work of bucketing, or hand-pumping has to be resorted to, from wells which are often remotely situated from the farm buildings."—(A. L. Hamilton, Margaret River.)

"The appeal for increased individual production on farms has received a definite stimulus through the availability of increased supplies of superphosphate, the farmer viewing the appeal in a much more friendly light than if superphosphate supplies had remained light."—(A. Hobbs, Fremantle.)

"Stock are in quite good condition and should be capable of high production for the coming season given normal conditions at the onset. The increased amounts of hay conserved this year, compared to the previous season, should materially aid in enabling farmers to take full advantage of immediate production, in instances where early calving has been arranged for. It is noticeable that the idea of providing for earlier calving is being generally aimed at by farmers in this area."—(A. L. Hamilton, Margaret River.)

Some Household Pests – Dried Fruit and Meal Insects.

C. F. H. JENKINS, Government Entomologist.

DRIED and preserved foodstuffs such as raisins, currants, oatmeal, nuts, and flour are often found to be "weevily" after long storage. Strictly speaking, the term "weevily" should be applied only to material attacked by certain types of beetles, but the expression is now popularly used in connection with practically any insect infestation of stored products.

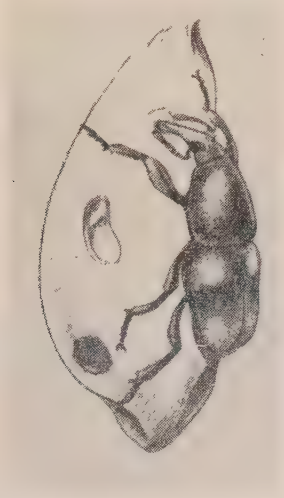


Fig. 1.
Rice Weevil (enlarged).
(U.S. Dept. Agric.)

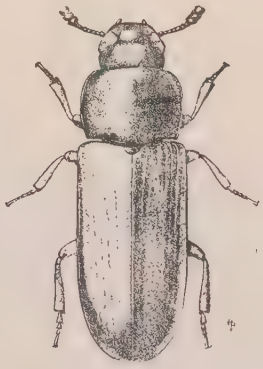


Fig. 2.
Flour Beetle (enlarged).
(U.S. Dept. Agric.)

Rice Weevils (*Calandra oryzae* L.)

The rice weevil is the common grain weevil of this State, and may sometimes be found attacking stored foods such as macaroni, spaghetti, etc., as well as grain.

Being a true weevil the head is produced into a long snout at the end of which the mouth parts are borne. The female weevil chews a small hole into the grain or other solid food material and deposits therein an egg; the hole is then plugged with a gelatinous-like material which seals the entrance. The young grubs hatch and feed in this position until full grown, when they pupate and finally the adult weevil forces its way to freedom.

Flour Beetles or "Mill Floss."

The flour beetles like the weevils are tiny brown insects which infest various foods, but chiefly flour, oatmeal, bran, etc. There are several species, all rather flattened in shape and lacking the typical weevil snout. The eggs are laid loosely amongst the flour or bran and under favourable conditions vast numbers may soon develop.

The Indian Meal Moth (*Plodia interpunctella* Hbn.).

The Indian meal moth is one of the commonest moth pests found in home groceries, and is the parent of the pinkish-white "grubs" or caterpillars so often found in raisins, dates, figs, etc. There are several other moths such as the flour moth (*Ephestia kuhniella* Zell.) and the dried fruit moth (*E. cautella* Walk.) which may also be implicated, but all are superficially very similar and have comparable habits.

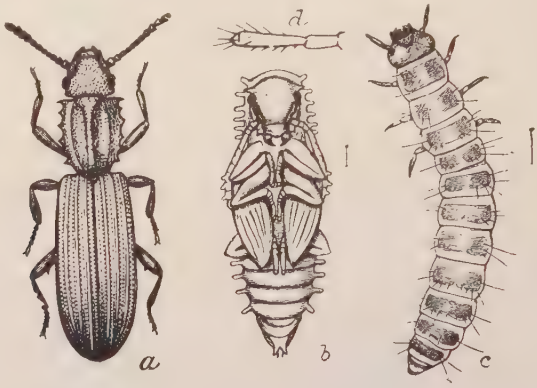


Fig. 3.
Saw-toothed Grain Beetle.
a, adult; b, pupa; c, larva (enlarged).
(U.S. Dept. Agric.)

The eggs are laid on or near the foodstuffs by the parent moth, which has a wing span of about ⅝ of an inch. When at rest the meal moth shows a broad creamy band across the general coppery brown colour of the wings.

CONTROL.

Prevention.—Housewives can do much to avoid losses by purchasing only small quantities of dried fruits, oatmeal, flour, etc., so that they may be consumed fairly quickly. Care should be taken to examine food before storing away to ensure that it is quite clean at the time of delivery.

In many cases insect infestations can be traced to an old packet of fruit, oatmeal, or flour, which has been pushed to the back of a cupboard and forgotten. All such centres of breeding should be destroyed. Wherever possible goods should be stored in insect proof tins or jars.

Astonishment is often expressed at the development of "weevils" in apparently sealed containers. The explanation is that insect eggs have already been laid on the food before it was packed away or in some cases that eggs have been laid around the lid and the tiny grubs have been able to squeeze through where no mature insect could gain access.

Treatment.—Where small quantities of material only are to be dealt with and where the damage done does not warrant the destruction of the food, good control may be obtained by putting the infested foodstuffs in the oven for about an hour and allowing the material to be warmed through to a temperature of from 130deg. to 140deg. F. Care must be taken to see that the oven is not too hot. A gradual heating at a low temperature will raise the entire mass to the desired figure whereas a short intense heating may entirely spoil the commodity being treated. During hot summer weather if the material is spread thinly and placed in the sun on a piece of iron, good control may be achieved.

Fig. 4.
Indian meal moth, showing silken webbing formed on grain.
(U.S. Dept. Agric.)

Where larger quantities of material require treatment these should be placed in a gas-proof box or bin and fumigated with carbon bisulphide. The dosage should be worked out at the rate of 4 lb. of fumigant to every thousand cubic feet of space but the amount used may be greatly increased if leakages occur. A bin measuring 3 ft. x 2 ft. x 3 ft. would require about 4 tablespoonfuls.

The fumigant should be placed in a shallow saucer on the top of the infested material and the lid and all cracks should be thoroughly sealed. The box should be left closed for 48 hours.

Warning.—Carbon bisulphide is explosive and inflammable, but will not injure the foodstuffs for future consumption, although the gas is toxic to humans.

Substitute Drenches for Treatment against Black Scour Worm.*

SUPPLIES of nicotine sulphate will be extremely low this year. The bluestone-nicotine sulphate mixtures have been used for treatment of sheep against black scour worm (small intestinal worm, hair worm, *Trichostrongylus*) for about ten years. In 1945 and probably in 1946 other drugs will have to be used.

The most effective drug is phenothiazine, sold as Phenovis, Phenzeen and Phenovine, and wherever possible it should be used, if not for the whole mob, at least for the tail. Supplies of phenothiazine are now ample. The dose rate for use against black scour worm is based on 1 lb. of the powder treating 20 grown sheep, 25 young sheep 8-12 months old, or 40 weaners 4-8 months old. The cost is the only disadvantage, but this is offset to a large extent by its high degree of efficiency.

The next most effective drug is tetrachlorethylene (perchlorethylene). This drug is effective only if swallowed into the fourth stomach and must therefore be given with or immediately after a dose of bluestone. Used in this way it is more effective than the commonly used bluestone-nicotine sulphate mixture. It is most conveniently given as a mixture with equal quantities of liquid paraffin, or as an emulsion. The doses of a 50-50 mixture with liquid paraffin are:—

Grown sheep—15 c.c. (= 7.5 c.c. tetrachlorethylene).
Sheep, 12-18 months—12 c.c.
Sheep, 8-12 months—8 c.c.
Sheep, 4-8 months—6 c.c.
Lambs, under 4 months—4 c.c.

The dose should follow a few seconds after a dose of bluestone solution such as 15 c.c. (½ fl. oz.) of 5 per cent., solution (1 lb. in 2 gallons) for sheep 8 months old and over, and 15 c.c. of 2½ per cent. solution (½ lb. in 2 gallons) for sheep under 8 months old.

In a proportion of sheep tetrachlorethylene will cause staggering and a few sheep will go down as under an anaesthetic. These effects usually appear within a few minutes and wear off within an hour or two, but care must be taken that sheep which go down do not suffocate. They should be propped against a fence in the normal lying position and the sooner they are up and walking about the better. When drenching, the race should be open into a big yard so that sheep do not go down where they are liable to be suffocated. Drenching should be carried out early in the day so that any ill-effects will have worn off before nightfall.

Sheep need not be starved before or after drenching. The drench should be given slowly. If squirted into the mouth it is likely to be inhaled and immediate and severe ill-effects will occur. Artificial respiration, if applied soon after ill-effects are seen, will revive most sheep that go down and cease breathing.

The efficiency of tetrachlorethylene depends on its being swallowed into the fourth stomach. This in turn depends on the action of bluestone on the swallowing mechanism of the sheep. On the average, bluestone brings about the desired effect in 90 per cent. of sheep. The 10 per cent. of failures commonly form the tail of the mob and can be treated effectively by using phenothiazine. It is always wise to use this drug for the tail.

Other drugs used in drenches, such as carbon tetrachloride, arsenic or bluestone, are not effective for killing black scour worm.

The black scour worm affects young sheep, particularly in the cooler months of the year. A plan of drenching in the control of this parasite should begin in the autumn and should be continued until spring feed comes away. Spring lambs should always be drenched at weaning time. The frequency of drenching should depend on weather conditions. The wetter the winter the more often is drenching necessary. Drenching three weeks after rain falling over several days is a sound precaution.

(In Western Australia, weaners usually show symptoms of infestation with the black scour worm during Summer when the feed is dry and its nutritive value is relatively low. Drenching should consequently be commenced in the Spring, just before the feed dries off, and continued if necessary throughout the Summer months. In this respect, conditions in Western Australia differ from those in the Eastern States, where drenching is recommended during Autumn and Winter.—Ed.)

Drenching alone will not always give complete control of this parasite. Improved management, including reduced stocking, rotational grazing, supplementary feeding and improved pastures, is essential.

If an outbreak occurs with rapid loss of condition and severe scouring, drenching, even with phenothiazine, will often fail to bring about a rapid cure. The severely affected sheep should be drafted off and specially fed on a highly nutritive diet, if necessary from troughs in yards. In an outbreak the sheep must be moved from the contaminated paddocks immediately.

* Reprinted from a statement issued by the McMaster Animal Health Research Institute, Sydney and made available by courtesy of the Director General of Agriculture (Hon. F. W. Bulcock). Further information on the use of tetrachlorethylene may be obtained, if required, from the Veterinary Officers of the Department of Agriculture, Perth.

Change of Seed Experiment.

A. J. Millington, Plant Geneticist; J. H. Langfield, Farm Manager.

EARLY in 1944 a group of Merredin farmers forwarded to the Department of Agriculture an extract from the "North British Agriculturist" containing a discussion of the beneficial effect of obtaining seed wheat from another district. The Professor Percival quoted is an eminent English Botanist and author of a classic monograph on the wheat plant.

In respect to a statement "that a change of seed wheat is no longer necessary as seed wheat can be successfully re-sown on land on which it was grown for at least twenty years," Percival asks, "On what kind of evidence is such a statement based? It is completely at variance with the advice, practice and experience of all the most skilled farmers throughout the ages in this and other countries. There is abundant witness of the beneficial effect of a change of seed of the same variety of wheat every two or three years from one climate, district or soil to another and I feel that any departure from this ancient and well tried practice would result in a reduced return of our most valuable and much needed cereal from the land as well as a financial loss to the farmer."

More general is the opinion that, whilst with some crops such as potatoes "seed" from a disease free district may be beneficial, with wheat no advantage will be gained where a farmer is already growing pure, disease free crops.

The seed portion of the cereal grain is the germ or embryo which arises from a fusion of the parental germ plasms. Where a variety has been "fixed" and bred as a "pure line" before its release to farmers as pedigree seed, no variation is likely to arise during the sexual phase in the plant's life cycle.

The absence of variability in the germ plasm will result in the varietal characteristics being transmitted unchanged from generation to generation, irrespective of the environment in which the crop is grown. With a "fixed" variety, plump, disease free grain, irrespective of the district in which it is raised, is suitable for seed.

The objective of the pedigree system of seed wheat developed by the Department of Agriculture is to provide farmers with pure seed of named varieties which they can systematically increase for their bulk plantings. It enables farmers with a minimum of expense and trouble to keep their crops relatively pure. The effectiveness of the system is shown by the extreme variability common in crops raised from varieties which are not distributed by a Department of Agriculture.

It is always desirable to differentiate between scientific opinion and scientific knowledge derived from controlled experimentation. A trial was therefore conducted during 1944 at the Merredin Research Station with seed from that and other Research Stations. In each instance the seed had been grown at the respective station for two or more years. No one variety was available from all Stations and consequently it was necessary to use two varieties, Bencubbin and Bungulla. Owing to severe rust epidemics at the Chapman, Wongan Hills and Salmon Gums Research Stations in 1943, the grain from these stations was pinched but germination was not notably affected. Chemical analysis showed differences in the protein content of the grain from the various sources.

No differences could be discerned between plots of the same variety during the early stages of growth, but with the dry spring weather, soil variations produced marked irregularity in the height of plots, even when they were sown with the same seed. This variability was reflected in the subsequent grain yields.

The yield obtained from each plot is given in Table 1. Appropriate mathematical calculations show that a difference of at least 1 bushel 54 lbs., due to soil variability and other uncontrollable factors, can be expected between the averages of plots receiving identical treatment. If the difference between any two averages markedly exceeded 1 bushel 54 lbs., it would be reasonable to expect that it was due to differences in treatment.

Table II. gives the average yields of plots sown with grain from the various seed sources but in no instance were the Bencubbin plots significantly different. The difference of 1 bushel 56 lbs. between the yields of the Bungulla seed ex Merredin and Chapman approached the amount covered by experimental variability, but the Merredin seed cannot be regarded as being significantly better.

In view of the season and the germination date, June 19th, it was anticipated that Bungulla would outyield Bencubbin.

CONCLUSIONS.

In all cases the Bungulla yields were greater than those of Bencubbin, indicating that variety, rather than the district in which the seed is raised, is of first importance.

The results give no evidence that farmers in the Merredin district would obtain better results by importing seed from other areas.

ACKNOWLEDGMENT.

Grateful acknowledgment is made by the authors of this article to the Superintendent of Wheat Farming (Mr. I. Thomas) under whose direction the investigation was conducted, for his advice and assistance at all stages of the experiment.

Table I.

CHANGE OF SEED EXPERIMENT.

$\frac{1}{8}$ acre Plot Yields in lbs. Layout: 6 x 5—Randomised Block.

Replication.	Bencubbin Seed.			Bungulla Seed.		
	Merredin.	Wongan Hills.	Avondale.	Merredin.	Chapman.	Salmon Gums.
1	103	86	96	154	102	131
2	105	113	102	131	114	123
3	103	93	106	114	117	114
4	92	70	93	109	102	99
5	100	76	92	91	91	114

Table II.

Variety.	Source.	Protein Content.	Per cent. Germination.	Yield.
		%	%	bus. lbs
Bencubbin	ex Merredin	12·3	99	13 25
	ex Avondale	9·05	98	13 2
	ex Wongan Hills ...	9·75	99	11 41
Bungulla	ex Merredin	...	97	15 58
	ex Salmon Gums ...	9·3	99	15 30
	ex Chapman	9·55	93	14 2
Difference for significance (P = ·05)		...	...	1 54

Distribution of Nitrogen-Fixing Bacterial Cultures—Twentieth Anniversary.

W. P. Cass Smith, Plant Pathologist.

THE year 1945 is the twentieth successive year in which bacterial cultures for leguminous seed inoculation have been prepared and distributed to farmers by the Department of Agriculture. The service commenced in 1926, when a pure culture of the lucerne strain of nodule-forming organism was obtained from the Rothamsted Experiment Station, England. At that time lucerne was proving very difficult to establish in many parts of Western Australia and failures were quite frequent. That these failures were largely due to lack of

the requisite nodule-forming organisms in the soil was first shown by Mr. W. M. Carne, formerly Botanist and Plant Pathologist. Carne subcultured and distributed the Rothamsted organism to farmers, with the result that lucerne was successfully established in many new areas, including a number where previously the crop had failed.

The same strain is still being grown on artificial media and distributed to farmers and it is as effective as ever. Since then, strains for the inoculation of other kinds of leguminous plants have been acquired from various parts of the world, or isolated locally, and this service to farmers has grown tremendously. For the 10-year period ending 1935 an average number of 273 cultures was issued to farmers yearly, whereas for the next decade the annual number will approximate 1,900.

Much of the credit for developing and popularising leguminous seed inoculation in Western Australia goes to Mr. H. A. J. Pittman, who succeeded Carne in 1929, and remained here as Plant Pathologist until 1938. During his time, cultures of a number of the various strains were issued to other Australian State Departments of Agriculture, where similar services subsequently developed. It is not surprising that leguminous seed inoculation has been so successful in Western Australia, for much of the country is very young agriculturally, and leguminous crops have therefore been planted very largely on either newly cleared land, or land where similar legumes have not been grown before. Under these conditions failure to impregnate the soil with the appropriate bacteria, either by seed inoculation or in some other way, generally results in crop failure.

An excellent crop of New Zealand lupins grown by the late Mr. J. Brindle, of Parkerville. This land had never grown legumes previously but following on the inoculation of the seed prior to planting, an estimated green yield of 20 tons per acre was obtained, which contained the equivalent of 712 lbs. of sulphate of ammonia per acre in terms of nitrogen.

Since the war, with its consequent shortages of nitrogenous fertilisers, the part played by leguminous crops, in conjunction with seed inoculation, in building up and maintaining soil fertility has assumed even greater importance. Orchardists, market-gardeners and home-gardeners alike have had to rely considerably on green manuring with legumes to maintain soil nitrogen at a sufficiently high lever for profitable crop production. A very effective strain for the inoculation of New Zealand lupins, has been isolated locally, and this is being widely used by orchardists in the lower South-West, for their green manure crops. When tested in the Parkerville area, New Zealand lupins inoculated with this strain and grown on new land, gave an estimated green yield of 20 tons per acre containing the equivalent of 712 lbs. of sulphate of ammonia per acre, in terms of nitrogen. Stock strains of bacteria are tested as opportunity permits for their continued effectiveness, and more effective new strains are also being sought.

NOVEL METHOD OF INTRODUCING THE NODULE-FORMING BACTERIA TO THE SOIL.

Growers who omit to inoculate various leguminous seeds prior to planting frequently enquire how this omission can be rectified when subsequently unthrifty growth occurs.

There are several ways of introducing the bacteria to the soil after sowing. For example, by watering on the culture, or by mixing the water-diluted culture with soil and broadcasting. Except for the treatment of small areas, however, these methods are expensive and impracticable.

In the case of subterranean clover the recommendation to re-seed with a light sowing of inoculated seed is usually made, and good results have been reported by farmers who have carried this out.

Recently, however, a novel method of introducing the bacteria to an established but unthrifty paddock of subterranean clover, by inoculating wheat seed, was reported to the writer by Mr. L. D. Anderson of Brookside Farm, Jennacubbine. The following extracts are taken from Mr. Anderson's descriptive letter, as the matter will doubtless be of interest to other farmers. "Last year I enquired whether cultures could be applied to say wheat for treating subterranean clover already established, but you were unable to advise definitely. You may be interested to know that I tried a small plot, and it appeared to be entirely successful as the growth of clover certainly improved, and plants dug up and washed had far more nodules on their roots than others not so treated. I used culture on the same quantity of wheat as if I had been treating clover seed, 1 x 8 ounce culture to each 100 lbs. I waited till we had received 150 points of rain to make sure of the clover germinating, and then combined in the wheat (inoculated the day before) about two inches deep. I combined strips across the paddock over a width of about 10 chains, leaving about 24 feet between each strip of inoculated wheat. The wider strips were combined with super only at the same rate per acre . . . . . so that both lots received a working and an application of superphosphate at the same rate. . . . . The difference was as marked as if one lot had received super and the wider strips had not."

Mr. Anderson is to be congratulated for his initiative and for reporting these interesting results.

Although leguminous seed inoculation has been practised in Western Australia for so many years, and in the aggregate much publicity has been devoted to the subject, there are still in Western Australia farmers both old and new,

Inoculation of leguminous seeds before planting with an appropriate strain of bacterial culture often results in greatly improved growth, and economy in the amount of nitrogenous fertiliser, or soil nitrogen required. The peas in the top row were grown from inoculated seed whereas those in the bottom row were not inoculated. The latter plants were stunted and finally died without bearing pods. Apart from inoculation differences, both lots received identical treatment and were manured with superphosphate only.

who have no knowledge about this matter, judging from letters and queries recently received. For their benefit the list of cultures available from this Department together with other important particulars is included hereunder. Numerous leaflets on this subject are also available on application.

Cultures Available.

Group A.—*Strain* 1 (Waite Institute Strain) Subterranean clover. *Strain* 2 (Local Strain) Drooping-flowered clover, ball or cluster clover, white Dutch clover, perennial red clover ("cow grass"), Egyptian clover (Berseem clover), and all other true clovers (*Trifolium spp.*).

Group B.—Lucerne, white sweet clover (*Melilotus indica*), "King Island Melilot" ("Hexham scent"), medics, trefoils, barrel clover and all other species of *Medicago* or *Melilotus*. (Rothamsted strain.)

Group C.—Garden pea, sweet pea, field pea, all kinds of vetches or tares, broad bean, lentil, tick bean.

Group D.—Tangier pea (*Lathyrus tangitanus*).

Group E.—W.A. blue lupin (*Lupinus varius*) and New Zealand blue lupin (*L. angustifolius*).

Group F.—Soy beans (*Glycine Max*).

Group G.—Sulla (*Hedysarum coronarium*).

Group H.—French beans (*Phaseolus vulgaris*), scarlet runner bean (*Phaseolus multiflorus*).

Group J.—Cow peas (*Vigna sinensis*), peanuts (*Arachis hypogoea*), Lima bean (*Phaseolus lunatus*).

Group K.—Japan clover (*Lespedeza spp.*).

Group L.—*Lotus major* and other Lotus species.

The members of each group are inoculated by the same kind of bacteria, but the plants mentioned in different groups require different bacteria. Persons ordering cultures should clearly specify the kind of seed to be inoculated. For example if "pea" bacteria are ordered it is impossible to tell whether "garden" peas, "cow" peas, or Tangier peas, etc., is meant, unless the qualifying word is also indicated.

APPROXIMATE AMOUNT OF SEED WHICH MAY BE TREATED WITH ONE BOTTLE OF CULTURE.

Size of Bottle.	Price. (Post free.)	Seed of size of Lucerne or Sub-Clover, etc.	Seed of size of Garden Pea, Lupin, Soy Beans, etc.	Milk required.	Tri-calcium Phosphate. (Supplied free.)
	s. d.				
1 oz.	1 6	Up to 15 lbs.	Up to 30 lbs.	¼-pint	1·5 gms.
2 oz.	2 6	Up to 30 lbs.	Up to 60 lbs.	½-pint	3·0 gms.
8 oz.	5 0	Up to 120 lbs.	Up to 240 lbs.	1 quart	12·0 gms.

N.B.—If a given size of culture is used to inoculate less seed than stated above the excess will do no harm.

Owing to the time taken to prepare the cultures, and owing also to the fact that in the busy time of the year there is frequently a tremendous accumulation of orders, farmers are requested to lodge their applications with the requisite payment enclosed at the Department a fortnight, at least, before they wish the culture to be forwarded.

Some Notes on Canine Distemper.

C. R. Toop, Senior Veterinary Surgeon.

DISTEMPER is the most common and by far the most serious disease affecting dogs in Western Australia. This disease has a world-wide distribution and is known to exist in all countries where dogs are kept. It has always been present in this State, but recently it appears to have become more prevalent and has taken a heavy toll. Many reports have been received of the existence of the disease in the farming and pastoral areas where the loss of a considerable number of valuable sheep dogs has occurred. In view of this, the following notes are submitted to enable owners to recognise the disease and to acquaint them with the measures which may be adopted to protect their dogs from infection.

Canine distemper is an acute highly contagious disease, which is caused by a filterable virus. The infection is spread from one dog to another by direct contact. Infection may also be spread by indirect means such as contact with an infected kennel or the consumption of food and water contaminated by the discharges of an infected animal

Young dogs between the age of three months and one year are principally affected. Mature dogs as the result of previous exposure to infection are usually immune to the disease. Dogs of all ages, however, which have not previously been exposed to the disease are highly susceptible. The mortality rate is high and it is estimated that from thirty to fifty per cent. of the dogs which become affected die of the disease.

SYMPTOMS.

The incubation period of the disease i.e., the time which elapses from exposure to infection to the appearance of symptoms, under natural conditions is usually about seven days. Symptoms, however, may appear as early as the third or fourth day or they may be delayed for as long as three weeks.

The earliest symptoms are rather indefinite and consist of listlessness and reduced appetite together with a slight watery discharge from the eyes and nose. During this period there is a marked rise in body temperature, which may reach 105°. After a few days the symptoms become more definite. There is a discharge of mucus and pus from the eyes and nose, shivering may be noticed, and a slight cough is usually present. The muzzle is hot and dry and may become blocked by the discharge causing the animal to breathe through its mouth. The animal becomes increasingly dull and listless, is disinclined to eat, and lies down and sleeps almost continuously. Yellow pustules are sometimes observed on the hairless areas on the under surface of the body. After the end of the first week various complications frequently make their appearance. These may include pneumonia which is denoted by constant and pronounced coughing and difficult respiration, gastro-enteritis which causes vomiting, diarrhoea and straining, and disturbances of the brain and spinal cord which may result in the development of convulsions, paralysis and chorea (twitching of muscles). In advanced cases of distemper the animal becomes extremely weak and loses a great deal of condition. In uncomplicated cases the disease runs a course of 3-4 weeks. Where there are complications several months may elapse before recovery occurs.

Dogs which have recovered from an attack of distemper often suffer serious after effects. Partial paralysis of the hindquarters associated with a swaying unsteady gait and chorea affecting the masticatory muscles which is accompanied by constant champing of the jaws are commonly observed.

Recovery from the disease results in the development of a strong and lasting immunity.

TREATMENT.

The treatment of a severe and complicated disease such as distemper presents many problems requiring the services of a qualified Veterinary Surgeon. Whenever possible veterinary assistance should be obtained without delay. If treatment is commenced as soon as symptoms make their appearance the chances of recovery will be greatly increased. In the early stages of the disease the injection of canine anti-distemper serum is of considerable value. Given in a dose of 10 cc. or more (according to the weight of the animal) and repeated at intervals of twenty-four hours if necessary, anti-distemper serum will frequently bring about a reduction in the severity of the symptoms which is followed by the recovery of the animal. When, however, the disease has existed for a week or longer and particularly after complications have set in, serum is generally of little value.

There are no drugs which have a specific action in the treatment of distemper, and beneficial effects cannot be expected from the various remedies reputed to possess curative properties. Recovery may be assisted by good nursing and careful attention to sick animals.

Dogs affected by distemper should be kept as quiet as possible and should under no circumstances be allowed exercise. They should be provided with clean, warm, dry, but well ventilated quarters, and should be kept clean by daily brushing and grooming. The nose and eyes should be kept free of discharges. The eyes should be bathed with a warm solution of boric acid and the eyelids

smeared with boric acid ointment to prevent gumming. The same ointment should be applied around the nostrils and will prevent cracking. The appetite should be encouraged with nourishing, easily digestible food such as milk, broth, minced beef and raw eggs. Food should be given in small quantities and at frequent intervals. Little and often is the rule which should be followed in the feeding of distemper cases. Food should not, however, be forced upon an animal which struggles or resists; the exertion involved is more likely to aggravate the condition rather than improve it.

The treatment of the complications which occur in distemper is a matter for the expert attention of a Veterinary Surgeon and will vary considerably according to the symptoms exhibited by the affected animal. A discussion of such treatment would serve no useful purpose here.

PREVENTION.

In the control of distemper it is important to prevent contact between infected and susceptible dogs. Since the disease is so widely distributed, this is difficult and is rarely possible in cities and towns where large numbers of dogs are kept. In country districts the difficulties are usually not so great, and when the disease is known to be prevalent, contact between dogs on neighbouring properties and especially with dogs in adjacent towns should as far as possible be prevented.

Newly-purchased animals should be isolated for three weeks before being allowed to come into contact with other dogs on the property.

After an outbreak of distemper has occurred and before a new dog is introduced, bedding and other material which may have been in contact with infected animals should be burned and the kennels should be disinfected with 5 per cent. lysol solution. As an added precaution the kennels should be allowed to remain vacant for three or four weeks.

IMMUNISATION.

Distemper may be prevented by the immunisation of susceptible dogs. In Australia the serum virus method of Laidlow and Duncan is employed and confers upon the treated animal a life-long immunity. Dogs should be immunised during the first year of life. Three or four months is considered the most suitable age. They should be in good general health at the time of treatment and should be freed from parasites. In the process of immunisation the animal is inoculated with a small dose of distemper virus followed an hour or two later by an injection of anti-distemper serum. In consequence of these injections the animal develops a mild controlled attack of distemper from which it rapidly recovers. This infection stimulates the formation of antibodies in the tissues and blood of the animal enabling it to resist the disease if subsequently exposed.

While undergoing immunisation the animal is capable of transmitting infection to other dogs and must be isolated for fourteen days. During this period it should be kept under close observation and daily temperatures should be taken. Apart from a moderate rise of temperature occurring usually on the fourth day the majority of dogs suffer no serious effects from the injections. In a small percentage of cases symptoms of distemper occur and this must be controlled by a further injection of serum.

Canine distemper virus is supplied by the manufacturers only to qualified Veterinary Surgeons. The virus is an extremely unstable product and unless handled in accordance with certain specified conditions it will lose its potency and prove quite useless as an immunising agent. Moreover in the handling

of a living virus special precautions need to be taken to prevent the spread of infection to other dogs. There are a number of other equally important factors to be considered and it is consequently essential that treatment of this kind should be undertaken only by a Veterinary Surgeon. In view of the wide distribution of canine distemper the immunisation of young dogs and puppies may be recommended as a routine practice.

In districts where veterinary services are unavailable it should be possible by a co-operative effort to arrange for the treatment of a sufficient number of dogs to warrant a visit by a Veterinary Surgeon from some other area.

Paspalum Grass.

Paspalum dilatatum Poir.

C. A. Gardner, Government Botanist.

H. G. Elliott, Agrostologist.

DESCRIPTION OF PLANT.

PERENNIAL grass with tufted ascending or erect culms, leafy at the base, 2-5 feet high, glabrous except the inflorescence. Inflorescence consisting of 3-7 spike-like spreading racemes 2-4 inches in length, towards the summit of the culm, the spikelets arranged in three or four rows along a flattened rhachis. Spikelets 1-flowered. Lower glume absent. Upper glume ovate-orbicular, shortly acute. Three-five nerved, pubescent on the back, the margins ciliate with silky hairs, with the addition of long hairs at the base of the spikelet. Lower (sterile) lemma like the upper glume in shape and texture, but smaller and usually glabrous, 3-nerved. Fertile lemma shorter than the upper glume and sterile lemma, almost white, crustaceous orbicular, almost flat, with closely inrolled margins embracing the margins of the palea, faintly 3-nerved, almost smooth and shining, but minutely rugose under a lens. The fertile lemma and the tightly embraced palea, enclosing the grain, readily fall from the spikelet, and are together called the "seed" in commercial terminology.

Of the six species of Paspalum recorded from Western Australia, two are native, the other four being introduced. *Paspalum dilatatum* is the one most common in cultivation. Originally native to Uruguay and Argentina, it was introduced into the United States of America about the middle of the last century, and is now firmly established and cultivated in the Gulf States, where it is known as "Dallis grass" after A. T. Dallis of La Grange, Georgia. This grass was introduced into Australia by Baron Von Mueller about 1880 and since 1898 its cultivation has steadily increased and the area now under paspalum in Australia is very large. In addition *Paspalum dilatatum* has many and varied vernacular names such as Paspalum Grass, Large Water Grass, Golden Crown Grass. The name *Paspalum* is from the Greek *paspalos*, millet; the specific name refers to the dilated rhachis of the raceme.

In the irrigation areas paspalum is spreading naturally and many farmers have permanent pastures consisting mainly of this grass either alone or in association with other grasses such as ryegrass and cocksfoot and legumes such as subterranean and white clovers or Lotus major. In moist situations, even on hillsides in the lower south areas, paspalum can be sown with success.

Paspalum dilitatum, Poiret.

Explanation of Plate.

A—Portion of plant.

B—Spike.

C and D—Details of spikelet.

Soil.

It is not particular to the type of soil as it will be found growing on light sandy to stiff clays where ample soil moisture is available, but as usual with plants of this kind the best growth is obtained on moist rich alluvial flats, or under irrigated conditions.

Time of Planting.

To obtain the most satisfactory results from seed, planting should be carried out in the early autumn or late spring months unless the land can be irrigated, then summer planting can be carried out. Germination of the seed is most rapid when the soil temperatures are high and the ground moist. Partial failures often occur when planting is carried out in the winter months when the land is cold and wet.

Method of Planting.

The ground should be well worked, firm and have a fine seed bed. The seed is usually sown in association with a clover such as white clover, 2 lb. per acre, drooping flowered clover, 4 lb. per acre or subterranean clover, 4 lb. per acre. After sowing the seed should be lightly covered with soil by using a T-Bar roller or light harrows. Deep planting must be avoided.

Rate of Seeding.

When sown alone up to 12 lb. per acre of seed can be used but when in mixtures the maximum rate to sow would be 8 lbs. per acre, but often as low as 4 lb. is used with ryegrass 4 lb., white clover 2 lb. or subterranean clover 4 lb. per acre.

Fertiliser.

Superphosphate at the rate of 1½-2 cwts. per acre is recommended but under irrigated conditions higher rates per acre can be used to advantage.

After Attention.

The period in which paspalum makes the most vigorous growth is from October to May, inclusive. Under ideal conditions the most rapid growth is made during January, February and March. It has a tendency during these months however to run to seed very rapidly and should be grazed heavily and mown to prevent the seed stems forming unless thickening up of the stand is required by seed production as many instances of the failure of this grass to spread have been due to excessive stocking which takes place during the dry summer months, preventing the plants from seeding and so spreading over the bare areas in a field.

To prevent the grass on the area becoming sod bound, it is necessary to carry out a system of efficient renovation so that clovers and other grasses can grow in association with it. Normally this renovation should be done in the autumn some 2-3 years after establishment. On old sod-bound paspalum swards complete breaking up and working down of the area is recommended and after a good tilth is produced, reseeded to ryegrass 4 lb.. and white 2 lb. or subterranean clover 4 lb .per acre. Under irrigated conditions perennial ryegrass 6 lb. cocksfoot 4 lb. and white clover 2 lb. per acre is recommended.

Ergot.

During recent years the paspalum in this State has been seriously affected with ergot (*Claviceps paspali*). The presence of ergot is noted when seed heads are formed as the seed heads become sticky. To control and avoid any stock trouble occurring from this disease, seeding should be prevented by mowing or grazing heavily during the hot summer months of the year.

Seed.

Paspalum grass normally produces seed freely but as the seed ripens from the tip of the head downwards and shatters off as soon as ripe, good germinable seed can be gathered only by hand. During recent years the quality of seed, which is obtained from New South Wales, has been particularly high, and the germination good. The number of seeds per lb. is estimated at 320,000 with a bushel weight of 20 lbs.

Feeding Quality.

Practically all classes of livestock will eat paspalum when young and vigorous. When not grazed efficiently in the early summer it runs to seed and the stalks become fibrous and tough. It will, however, remain succulent and nutritious when managed and grazed efficiently.

Frosts.

As paspalum is a heat-loving grass it will only stand very slight frosts before turning brown, but in the spring with the event of warmer weather, together with ample moisture it starts growing and producing a large bulk of good feed.

To summarise it can be said that paspalum has many advantages as well as disadvantages.

The advantages are—

1. It is a perennial summer producing grass.
2. It is very drought resistant and thrives on moist soils.
3. Will stand any amount of abuse by stock.
4. Gives green feed in the early summer, summer and autumn months.
5. Seed will be dormant in ground for months until conditions are favourable for germination.

The disadvantages are—

1. Very susceptible to ergot.
2. Not very palatable when rank or old.
3. May become troublesome under irrigated conditions.
4. Will not stand severe frosts.
5. Seed matures unevenly causing low germination and as it is hand harvested it normally is of a high price.

Sarcoptic Mange of Pigs.

C. R. TOOP, Senior Veterinary Surgeon.

THE extent of the losses which Sarcoptic mange is capable of causing to the pig industry does not appear to be fully realised. This disease is already well established in this State and steps should be taken to ensure that infection does not become more general.

Sarcoptic mange is a contagious skin disease caused by a parasitic mite which forms burrows in the skin causing intense irritation. In consequence of this, young pigs become stunted and unthrifty, and the fattening of older animals is considerably delayed.

The occurrence of Sarcoptic mange on a property always results from the introduction of infected animals, and pig raisers should take the precaution of making a careful inspection in order to assure themselves that there is no evidence of infection when purchases of stores or breeding animals are being made. Once introduced, the infection usually spreads steadily throughout the herd and thereafter becomes a source of considerable loss. Fortunately the disease is amenable to control and may be entirely eradicated by the adoption of a simple and relatively cheap method of treatment.

CAUSE.

The mange mite of the pig is known as *Sarcoptes scabiei suis*. The female mite is about one-fiftieth of an inch in length and the male is somewhat smaller. These parasites are white or yellowish in colour and though not readily visible to the naked eye they may be detected under a hand lens or the low power of the microscope when scrapings taken from the skin of an affected pig are examined.

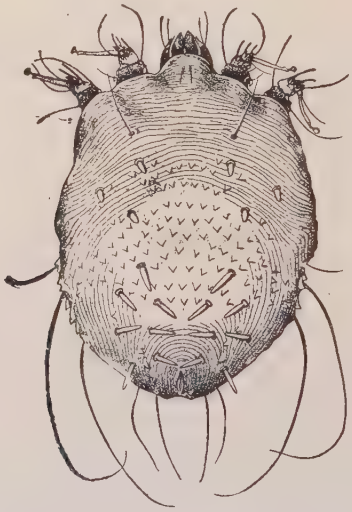


Fig. 1. The mange mite of the pig, *sarcoptes scabiei* var. *suis* magnified 100 times.

—After Imes.

The body is rounded and the mature parasite has four pairs of short thick legs. The mange mite spends the whole of its life on the host animal obtaining its food requirements from the skin tissues and blood. The female mites burrow into the skin, each making a separate gallery in which the eggs are laid. Each female lays from 10 to 25 eggs, which hatch out in from 3 to 10 days giving rise to a new generation of mites. These form new burrows and commence laying eggs when 10-12 days old. The complete life cycle occupies 2-3 weeks. Under favourable conditions the mites continue to multiply rapidly and the whole skin surface of the body may become involved in the space of six weeks.

MODE OF TRANSMISSION.

Sarcoptic mange is transmitted from one pig to another by direct contact. When the disease makes its appearance in a herd there is invariably a history of new pigs having been introduced at some time or other to which the infection

can be traced. The spread of the disease is usually much more rapid when pigs are in close contact with one another in small enclosures than when running in large yards or paddocks.

In addition the disease may be spread by contact with infected premises. Although the mange mite is unable to propagate apart from its host it is able to survive for a short period after it has become dislodged from an infected animal. Under cool moist conditions the parasites may survive in bedding and litter for as long as four weeks. When the conditions are hot and dry they do not survive for more than a few days. These factors require to be taken into consideration when measures for the eradication of the disease are being applied. It may incidentally be mentioned that the mange mite of the pig is transmissible to man. Although the parasites do not become permanently established on the human body they may cause considerable irritation and annoyance which may persist for several weeks. The precaution should be taken of changing the clothing and bathing after handling infected pigs.

Fig. 2. A young pig showing advanced symptoms of sarcoptic mange.
—After Hutyra and Marek.

SYMPTOMS.

The predominant symptom is intense itching resulting from injury and inflammation of the skin caused by the burrowing of the female mites. Affected pigs continually rub themselves against fences, posts, feed troughs and other objects and scratch at the body with their hind feet. The skin is scaly and studded with small nodules which form around the entrance of the burrows. From constant rubbing, parts of the body, particularly the sides, shoulders and thighs, become denuded of hair, and as the result of mechanical injury to the skin large scabs make their appearance. In advanced cases the skin becomes thickened and leathery and is thrown up into wrinkles or folds. The infection usually commences around the ears, eyes and nose, and from there spreads along the neck, sides and back until the whole body becomes involved.

Pigs of all ages and breeds are susceptible. Young pigs, however, are most seriously affected and this is especially the case if they are debilitated as the result of inadequate feeding or from the presence of another disease. In consequence of the severe and constant irritation young pigs cease to make normal growth, becoming stunted and unthrifty. Death may occur in severe cases. In older pigs fattening is delayed and the age increased at which they may be marketed.

DIAGNOSIS.

Symptoms of skin irritation may result from other causes. Lice if present in small numbers cause considerable irritation, accompanied by symptoms of frequent rubbing and scratching. Pig lice, however, on account of their large size will be detected without difficulty. Moreover, the itching caused by the mange mite is much more severe and if in addition there is evidence of thickening and wrinkling of the skin this will usually serve to place the diagnosis beyond doubt. If confirmation is desired this may be obtained by the demonstration of mange mites in scrapings removed from the skin of an affected animal. Deep scrapings should be taken with a blunt knife, the skin being scraped until the blood just commences to show. All of the material so removed should be transferred to a small container and forwarded to this Department for examination.

Fig. 3. Pigs passing through an oil dip.

TREATMENT.

In the control and eradication of mange in pigs excellent results may be obtained from the application of crude oil or used lubricating oil. Oils from which the lubricating constituents have been removed are unsuitable. Sump oil which is cheap and readily obtainable is very effective. The oil may be applied by dipping, spraying or hand dressing. Dipping, however, provides the only practical and really effective method of control and this is particularly the case when the treatment of herds containing a large number of pigs is involved. Dipping presents no great difficulty and provided the dip is equipped with a strong well constructed entrance race and exit ramp the pigs will run quite freely.

The dip which is reproduced in the accompanying photograph has been used with very satisfactory results. It is built of concrete, the walls being 4½in. in thickness. It is 21ft. long, 2ft. 6in. wide and 6ft. deep, and is provided on either side with a closely boarded wall 2ft. 6in. high to prevent splashing. A dip of the above dimensions will contain sufficient fluid to completely immerse large boars and breeding sows. Actually, the depth of a pig dip need not exceed 4ft. Originally installed in connection with eradication of mange, this dip has since been successfully used for the control of lice against which parasite both sump oil and crude oil are highly effective. Dips of this type could with advantage be installed on all large piggeries.

In preparing the dip for use it should be filled to the required level with water following upon which sump oil or crude oil should be added until it forms a layer 6in. in depth floating on the surface of the water. As it swims through the dip the body of the animal becomes completely coated with oil. In order to destroy mange mites which have established themselves around the ears, eyes and nose, the head of each animal should be ducked by means of a crutch or forked stick as it passes through the dip. Each pig removes a quantity of oil from the dip. In the treatment of mixed herds an allowance of 1½ pints per head should be made and the dip should be replenished from time to time as required. A draining pen should be provided for the collection of the surplus oil which drips from the animals.

After dipping with oil, care should be taken to prevent exposure to bright hot sunshine. The pigs should be handled quietly and allowed to rest for 24 hours in well shaded yards.

In order to completely eradicate the disease dipping of the whole herd is necessary. If treatment is restricted only to those animals which are obviously affected this will result in pigs in the early stages of the disease escaping attention and they will continue to transmit infection to other animals with which they are in contact. Sows within two weeks of farrowing should not be dipped but they may safely be treated together with their litters when the young pigs are about four weeks old. If treatment is undertaken early it is possible to completely eradicate mange from a herd of pigs by a single dipping. When the disease is more advanced and there is evidence of thickening and wrinkling of the skin, together with a scab formation, two or more dippings repeated at intervals of 10 days will be necessary before this result can be achieved.

In the absence of a dip the oil may be applied by spraying. A stirrup pump fitted with a hose and a Bordeaux nozzle may be used for this purpose. Sump oil will pass freely through a nozzle of this type. This method of treatment, however, is much slower and more wasteful of material, and since it is difficult to completely cover the body of the animal with oil it is less efficient than dipping. Hand dressing is even less satisfactory and is only practicable when the treatment of a very small number of animals is involved.

Lime-sulphur dips are also effective for the control of mange. These are most conveniently prepared by the dilution of concentrated solutions of lime-sulphur which are available commercially and are more reliable than home-prepared mixtures. One proprietary preparation of concentrated lime-sulphur is available in this State and when diluted in the strength of one part of the concentrated solution to 12 parts of water will be found to give satisfactory results. Warm water should be used in the preparation of the dip, which should be maintained at a temperature of about 100° F. Using lime-sulphur solution four dippings repeated at intervals of seven days are necessary to eradicate mange from pigs.

After dipping, the pigs should if possible be transferred to clean quarters. If this is not possible the quarters which they occupy should be cleansed by gathering together and burning all bedding and litter and spraying the walls and floor with five per cent. Lysol solution (eight ounces of Lysol to one gallon of water). This will destroy mange mites remaining on the premises which under favourable conditions are capable of surviving for several weeks and of reinfecting the treated animals.

After the disease has been eradicated the precaution should be taken of dipping all newly purchased animals before their introduction into the piggery is permitted.

The Use of the Tuber–Unit Plots in the Production of Seed Potatoes.

E. T. Morgan, Officer in Charge, Potato Branch.

THE common experience of potato growers in nearly all parts of the world, in past years was that sooner or later good potatoes degenerated to such an extent that they became unprofitable by reason of reduced yields per acre. It was often quoted that potatoes had "run out," and this degeneration occurred to a greater extent in some varieties than in others. It is interesting to note, however, that some of the present day popular varieties were introduced many years ago. For instance, Brownell's Beauty, so popular in Tasmania, was produced in 1873, while the Delaware, the favourite variety in Western Australia, was produced in America in the year 1888. On the other hand, some varieties have degenerated in a comparatively short space of time.

About twenty-five years ago it was discovered that certain virus diseases were important to potatoes, and it is now recognised that the main reason for the deterioration of good potatoes, is not generally environmental conditions, but is usually infection from those virus diseases. The effects of those diseases are not apparent in the tubers and can only be detected and recognised by inspection of the growing crop. For this reason, it is impossible, by looking at a bag of seed potatoes, to judge whether such seed is good or bad from a virus disease or production standpoint. Many different virus diseases are recognised by Plant Pathologists throughout the world, and of these, some are carried by certain varieties of potatoes without apparently causing much reduction in vigor and yield.

However, of the diseases which do adversely affect potato plants, severe mosaic and leaf roll are in evidence in Western Australia. The former trouble manifests itself in a mottling and crinkling of the foliage, whereas the latter shows as a general dwarfing of the plants with rolling of the lower leaves, the plants yellowing prematurely, and the yields suffering in comparison with those from healthy plants.

Leaf roll is definitely the worst of the virus diseases as affecting yields in this State, but is not so easily recognised by growers as is mosaic. Mosaic infection is recognised soon after the plant emerges from the ground but it is not until a month after emergence that the first symptoms of leaf roll show, and it is then not recognised by many producers. At this period a colour change begins to

show on the lower leaves, a dirty yellow merging into the green of the leaf with a purple necrotic spotting being in evidence at times. These lower leaves thicken and become brittle and crack easily when folded. Rolling of leaves becomes pronounced as growth progresses and at this stage is recognised by experienced growers.

As these diseases live in the sap of plants they are not arrested by sprays or other treatments that are effective in controlling some other diseases and pests of plants. Unfortunately virus troubles may be transmitted from unhealthy to healthy plants by sucking insects, such as aphids, and also by contact. It is therefore not unusual to find that tubers lifted from apparently healthy plants, show the effects of virus disease when planted again. This results from infection having taken place in the previous crop without showing symptoms during the period of growth. It will thus be seen that the selection of vigorous, healthy looking plants cannot always be relied on to provide good seed, unless it is done from a crop relatively free of trouble. If we are to maintain the productiveness of our stocks, great care is necessary; the only control of these diseases is by eradication of the diseased plants as early as possible. With this in view the Government Certified Seed Potato Scheme was introduced in 1926, and by the use of such certified seed, serious virus diseases were considerably reduced.

The improvement of the potato by selection is a field of endeavour in which every grower interested in the problem of increased production per acre can engage. However it is very difficult to maintain even relative freedom from diseases when selection is made from commercial areas. This can only be done effectively in a special seed plot and such plot should be well isolated from commercial plantings. A minimum distance of 200 yards should be allowed from other growing potato plants. The best and only reliable time to establish such a seed plot is during the winter period, as virus diseased plants are more easily discerned in colder weather. High temperatures have the effect of somewhat masking the symptoms of these diseases and greater difficulty is experienced in detecting and eradicating affected plants. In the colder weather insects such as aphids and thrips are not plentiful and the risk of transmission of diseases is minimised. For this reason, in some countries, it is usual to purchase seed potatoes from colder parts for planting in warmer areas; for example, seed is taken from Scotland for planting in England, and much of the seed used in the United States of America is grown in Canada.

In such countries, one main crop a year is grown, whereas in this State potatoes are planted practically all the year round. Thus it is possible for us to establish seed plots at the time of year, when from practice we know that best results can be obtained.

Prior to the year 1937 under the Certified Seed Potato Scheme seed plots were inspected to ascertain whether rogueing, i.e., the taking out of diseased plants, had been thoroughly carried out. Where growers were not experienced in this regard demonstrations were given. However, it is practically impossible to rogue out every plant that may carry leaf roll, because some show very slight symptoms. Although considerable improvement was effected by the use of such seed plots it was concluded that still better results could be obtained.

In 1937, therefore, the writer introduced the tuber-unit system in connection with the planting of seed plots. In this system, as the name implies, large tubers are cut into sets, tubers being selected which are sufficiently large to allow of cutting four or more seed pieces from one potato. The sets from each tuber are planted consecutively, comprising a unit, these sets being planted about 15

inches apart along the row. A double spacing, i.e., about 30 inches, should be left between each succeeding unit. Planting can be undertaken from boxes specially adapted for the purpose. A kerosene case divided in half, sidewise, can be divided into 12 sections, something on the same principle as an egg crate. A tuber is cut into each section and planting proceeds directly from such boxes.

As plants grow, careful inspection is made and should any seed piece of the unit produce a diseased plant, the whole unit is discarded. This is essential because of the fact that part of a potato tuber may produce a plant giving easily recognisable symptoms, while other sets from the same tuber may give plants which can hardly be detected as carrying infection. Indeed the increased probability of detecting disease carrying tubers by using a number of sets together, is one of the basic reasons for the success of this method of seed selection. In rogueing, discarded units should be pulled and put into bags with a view to immediate removal from the site. In pulling the plants, careful handling is necessary to avoid as far as possible shaking off any aphids, which, if left can easily travel to other units, subsequently affecting them.

The tuber-unit or indeed any special seed potato plot should be established on an area as far from vegetable crops as is consistent with convenience. Such a location not only minimises the risk of infection from other potato crops but is also less likely to be inhabited by insects which could carry disease from unit to unit.

Some of the advantages accruing from the use of tuber-unit seed potato plots are:—

1. The greater certainty of detecting plants affected with virus disease, by reason of a number of such plants being together.
2. The earlier detection of such diseases, allowing rogueing to be undertaken sooner, thereby lessening the risk of transmission.
3. The limiting of the points of infection for the transmission of disease. The keeping of plants together in a unit makes one point of infection rather than a number spread over a wide area which happens when planted under ordinary methods.

Tuber-unit plots should be planted with the best seed available, to minimise the number of units that will require discarding.

The tuber-unit principle can be adopted in the planting of seed plots, from specially selected plants. In such case the whole of the product of one plant is utilized as a unit.

In choosing plants to be used in such a seed plot, vigour and freedom from apparent disease form the basis for selection. In advocating the selection of plants, it is recognised that experimental work has demonstrated that no improvement has been effected by continued selection of vigorous plants, where disease has been absent,* but many commercial varieties of potatoes are not healthy.

Our "Delaware," in common with many other varieties, carries X virus—so called healthy potato virus. Often no symptoms show under field conditions and can only be detected following inoculation to susceptible plants, which show definite symptoms. This work is, of course, undertaken by the Plant Pathologist.

It appears, however, that there are various strains of X virus, some strains affecting yields more so than others.

* "Some Factors Affecting Seed Potatoes," E. T. Morgan, Journal of Agriculture, W.A. Volume 15, (Second Series), No. 2, page 150.

For this reason the selection of plants may allow of improvement and help the practical grower to take advantage of the findings of the scientist.

It is reasonable to suppose, *where potatoes are grown under the same conditions,* that the more vigorous plants or units may be infected with milder strains of X virus, than others in the same plot, which are less vigorous, and which may be infected with more severe strains.

Selected plants should be staked or marked in some way during the growing season, avoiding, as far as possible, the marking of tops in the near vicinity any others showing crinkled or mottled foliage and dwarfed and leaf rolled plants.

Fig. 1. Cutting potatoes into boxes adapted for tuber-unit planting.

If the product of each root is placed in a separate package, any plants that have picked up disease infection will be together when they are planted. Where disease symptoms show, the whole series of roots from the one infected plant is discarded. Each unit should be separated from the next one by a 4 ft. to 6 ft. spacing along the row.

It is not suggested that tuber unit or root selection seed plots should be planted on a large scale, as too much work would be entailed.

Under the Certified Seed Potato Scheme it is necessary that an initial tuber unit seed plot be utilised. In the Albany-Denmark area, these plots are established on high land, in the June to August period. This crop is harvested during November and December, the seed from the area being again planted on high land in the period March and April. This latter, so called "Autumn" crop is not planted on the tuber unit system, but inspection is carried out during the growing season, and any plants showing infection are required to be "rogued" out. This crop is dug mainly during August and September, the seed being utilized for planting the main swamp crop in November to December.

It is from this latter crop that the main bulk of "certified" seed is made available, being dug in March and April, for growers who plant in the South-West areas during June and July.

This sequence of planting will serve to show that a tuber unit plot of relatively small size can be used, and this is governed to a great extent by the

Fig. 2. Showing the planting of units direct from the planting box. The distance between the foot and hand of the operator gives an idea of the distance allowed between units.

area that will eventually be planted as a "swamp" crop. If a tuber unit plot of two bags of potatoes is planted, it is reasonable to expect a return of 16 bags, allowing sufficient seed for the sowing of about 1¾ acres in the Autumn crop. As this latter crop grows into the cold weather small yields are usually obtained, but ample seed from this crop should be harvested to plant an area of from 12 to 15 acres during the November-December period.

If "rogueing" has been thoroughly carried out, both in the tuber unit and following crop, little if any discarding is necessary in the "swamp" crop.

It is not suggested the "certified" seed is 100 per cent. free of apparent virus troubles or that it ever will be.

Transmission of virus diseases is continually going on, and this can proceed very soon after emergence of affected plants, and before symptoms show up and allow of their being "rogued" out. Because of this it will be recognised that continued attention is necessary if seed is to be kept reasonably free of trouble, thereby assuring its giving maximum production. The use of tuber unit plots is recommended to growers as the best practical means of attaining this objective.

Portion of this article has been adapted from a broadcast delivered by Mr. Morgan from Station 6WA and acknowledgment is made to the Australian Broadcasting Commission for permission to publish.—Editor.

Bulldozer Demonstrations.

CLEARING VIRGIN COUNTRY IN SOUTH-COASTAL AREAS.

M. Cullity, Superintendent of Dairying.
C. W. Tobin, Dairy Instructor.

DURING the year 1944 a D7 bulldozer, caterpillar type, owned and operated by the Public Works Department was made available for clearing land intended for potato growing in the south-western districts.

While this work was in progress a programme of demonstrations covering many different types of country throughout the south-western portion of the State was planned.

The first stage of this programme was commenced in January of this year, when the bulldozer was sent to the Kendenup area.

Since then demonstrations have been carried out on five properties.

It is intended that when the programme of demonstrations in the south coastal area is complete the machine will be made available for sinking dams in certain key districts and then will be moved to the lower south-western districts in order to carry out further demonstrations.

The cost of operating the machine has been estimated at £10 per day of eight hours.

The following reports give some idea of the type of work which has been carried out and the interest which has been displayed by farmers.

W. FROST, KENDENUP.

The first demonstration of bulldozer clearing in this area was commenced on Mr. Frost's property on the 8th January, 1945. Timber on this block represented a fair average of that growing in the Mt. Barker-Kendenup district, being jarrah, redgum, yate, and small whitegum. The soil is of a light gravelly type to a dark sandy type, under which there is a clay pan. The area cleared totalled 135 acres on two blocks, one of 111 acres of clearing and the other 24 acres. Timber density averaged from 150 to 200 trees to the acre, varying in size from 4 inches to 15 inches in diameter. There were also a few large dry trees standing and all except four were removed.

After a few hours operating in the paddock, it was quite evident that this machine could revolutionise the clearing of light or medium timbered land in this part of the country. A few of the larger trees were allowed to remain. Farmers showed a keen interest in examining the holes left after the trees were pushed out, also how many trees were broken off at the bottom, etc. The result was particularly good; root holes were not deep because the bulldozer blade swept over the ground in pushing the tree away from the hole, therefore, the soil was practically all replaced. Breaking off only amounted to about 5 per cent., while trees left standing amounted to five to the acre.

Spectators from Kojonup, Cranbrook, Tambellup, Darkan, and many from wheatbelt centres visited the site and seemed favourably impressed. A conservative estimate of the number of spectators would be 1,000.

A. BRACKNELL, NAPIER.

This property is situated 20 miles north-east of Albany on a Lands Department settlement block about 14 years old. Twenty-two acres of virgin redgum-jarrah country in one block, and 4½ acres in another were cleared in four working days.

Timber density ranged from 100 to 150 trees to the acre, 6 inches to 3 feet in diameter, growing on a light sandy gravelly type soil with clay about 2 feet below the surface. The large trees on the virgin country were not as firmly in the ground as re-growth timber dealt with earlier, therefore, the machine could push out some trees up to 2 feet 6 inches in diameter. On the first block nine trees to the acre (five redgum and four jarrah) over 2 feet in diameter were left standing. On the second block six to the acre were left (four redgum, two jarrah).

The Albany District Development Committee arranged bus transport for visitors from Albany. As far as can be ascertained about 500 spectators visited the site while the machine was working. Working time was less than expected owing to the clearing being easier than anticipated.

C. T. HORTIN, KRONKUP.

On this property various classes of clearing were undertaken with the bulldozer, and in all 86 acres were cleared in 124 working hours. To obtain a reasonable estimate of costs it would be better to subdivide the area into five parts and comment on each separately.

1. Twenty acres of 25-year-old re-growth karri and redgum saplings from 6 to 12 inches in diameter growing on deep red sandy loam soil. Density, 400 trees per acre. The trees were tall, strong and firmly rooted, and the timber density made heavy going for the machine especially after it had been knocked down. The percentage of broken off trees was higher than anything else dealt with down here, and this is probably due to the accumulation of down timber congesting the area being cleared. The karri was particularly difficult to root out. Twenty trees to the acre were left standing, and approximately 20 per cent. broken off at the bottom. Working time, 37 hours.

2. Twenty-two acres redgum and karri saplings up to 12 inches in diameter, and blackboys. Saplings 60 to the acre and blackboys about 250. One tree to the acre left, and 10 per cent. broken off. All blackboys cleared right out. Working time, 32 hours.

3. Eighteen acres of blackboys including five to six dry trees to the acre 1 to 2 feet in diameter. Blackboys 400-500 to the acre. Dark red sandy soil. All trees were knocked down and blackboys were swept into windrows. Less than 1 per cent. blackboys broken off. Working time, 18 hours.

4. Seven acres half redgum and karri saplings similar to No. 2 area, and half blackboy similar to No. 3. Four trees to the acre left and all blackboys cleared out. Working time, 11 hours.

5. Nineteen acres of dry redgum and jarrah trees 1 to 3 feet in diameter, 150 to the acre. Trees were knocked down and swept into large heaps ready for burning. Only five trees left standing on the whole area. Working time, 26 hours. This is particularly interesting because a paddock of dry timber had not previously been undertaken down here, and it is now evident that the machine can deal with this type of clearing just as successfully as any other jobs so far tackled. The 19 acres can become a totally cleared paddock under pasture in six months if the fire is put in now.

The demonstration was witnessed by at least seven to eight hundred visitors.

W. H. YOUNG, YOUNG'S SIDING.

When the bulldozer was put to work on Mr. Young's blackboy flat on 15th March, 1945, it was quite evident that this type of country presented no difficulty whatever to the D7 machine. In eight working hours, eight acres of blackboys were knocked out and swept into rows. Several places had 800-900 blackboys to the acre and the whole area would average approximately 550.

The number per acre made practically no difference to the running of the machine, 900 being knocked out just as easily as 400. Breaking off only amounted to about 2 per cent.

The lesson learnt from this demonstration is that the D7 machine is only working on about one-third of its power when sweeping this type of country with a 12 foot blade.

The pre-war price for knocking down blackboys using a horse was £5 per acre.

The demonstrations proved successful in every respect and have provided proof of the possibility of reducing costs of development in the types of country in which the machine was used. The large volume of applications by farmers for the use of the bulldozer has indicated their confidence in this method of clearing. Apart from a considerable reduction in cost, an impressive feature is the speed with which the work is completed.

A Note on the Occurrence of Sclerotinia Twig Blight of Oranges.

W. P. Cass Smith, Plant Pathologist.

In December last, orange twig specimens from Mr. A. Moore's orchard at Brookhampton affected with a blight, were submitted by Orchard Supervisor Roy L. Cailes. The disease was identified as Sclerotinia twig blight caused by the fungus *Sclerotinia sclerotiorum*.

This fungus has a wide host range, and it is frequently noticed here in the cold weather, causing especially, a stem rot of orchard cover crops, e.g., tick beans, and New Zealand blue lupins; a head rot of mature cabbage and cauliflowers; and stem rot of tomatoes. However, as far as can be ascertained, this is the first record of its occurrence in Western Australia on the woody parts of citrus species.

Symptoms.

On each specimen submitted the disease had commenced on small lateral twigs killed or injured by frost, and had gradually spread back on to the parent branches. Some of the latter were completely girdled, resulting in a withering of

Fig. 1. Sclerotinia twig blight of oranges. The disease has spread back from small lateral twigs, killed or injured by frost, to the parent branches, some of which are completely girdled. Note the black seed-like bodies or sclerotia of the causal fungus, Sclerotinia sclerotiorum, at points indicated by arrows. Note also at right, the shredded fibrous bark part of which has been lifted to show the flattened sclerotia underneath.

distal parts, while on others the girdling was not yet complete. The bark lesions varied in colour from brown to light buff, being darker at the advancing margins than in the centres. Older lesions had weathered down to a light putty colour, and on the larger twigs, the bark had become shredded and fibrous. According to Fawcett* this weathering of the affected bark to a lighter shade, followed by the shredded fibrous condition, is fairly characteristic of the disease and serves to distinguish it from a somewhat similar trouble caused by the common grey mould fungus *Botrytis cinerea*.

* Fawcett, Howard S., 1936. Citrus Diseases and Their Control, pp. 329-331. McGraw-Hill Book Co., New York and London.

The white cottony mycelium of the causal fungus together with hard black seed-like bodies (sclerotia) were present externally on some lesions, while in others flattened sclerotia could be discerned under the shredded bark.

Contributing Factors.

Apparently, judging from Californian experience described by Fawcett, the fungus is unable to invade healthy citrus twigs directly, but it may spread thereto from dead or injured tissues which it readily infects under certain conditions. In this case it is clear from information supplied by Mr. Cailes that primary injury had been caused by late spring frosts. These frost-injured tissues were invaded by the fungus and subsequently the unusually cool, moist weather conditions in November and December contributed to the spread of the disease.

The twig blight was noticeably most serious in the lower lying portions of the orchard where the heaviest frost occurred.

As the fungus is so frequently found attacking winter cover crops, it seems very probable that the orchard cover crop was the source of the outbreak in the orange trees.

The dark seed-like bodies or sclerotia produced in such infected material are resistant to temperature and moisture fluctuations, and thus they serve as resting bodies which lie dormant in the soil and perpetuate the fungus through the hot summer months. Ultimately, the sclerotia germinate, when they may either produce new cottony threads capable of infecting susceptible plants directly, or they may send out slender stalks bearing saucer shaped discs on the tips (apothecia).

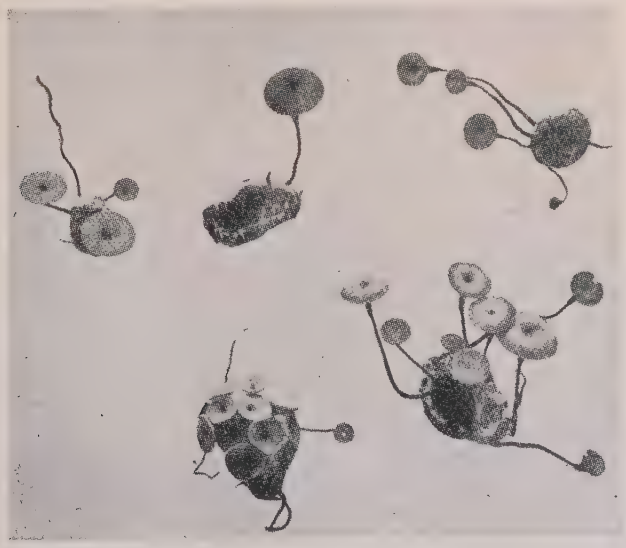


Fig. 2. Apothecial discs which bear the spore stage of the fungus, Sclerotinia sclerotiorum, growing from sclerotia.
(After Chupp.)

The discs contain numerous spore sacs on their top surfaces and from these the spores are ejected into the air. Borne by air currents, some of the spores may lodge on the twigs of the trees in the orchard or on other plants of a susceptible kind, where under suitable conditions, new infections occur, and the cycle is completed.

Control Measures.

As the parasite has been recorded on other hosts from so many widely separated localities in this State, over a number of years, and as this is the first record of the disease, it seems likely that Sclerotinia twig blight of oranges or other citrus species will prove of only minor importance here.

However, citrus growers should be on the look out for the disease in late winter or spring, especially after frosty weather, and should submit any specimens showing suspicious looking symptoms. If the disease occurs, infected twigs should be cut off and burned to prevent a possible further spread of infection, and if the orchard cover crop is also infected, this should be buried deeply when ploughing under takes place.

The routine spraying of the trees with Bordeaux mixture, 4 : 4 : 40 strength, prior to the winter rains may also afford protection.

Flax Crop Competition, 1944.

H. G. ELLIOTT, Agrostologist.

H. K. GIBSONE, Assistant Irrigation Officer.

DURING 1944 the Commonwealth Flax Production Committee donated a sum of £50 to each flax-producing State in the Commonwealth as prize money for a Flax Crop Competition. The Western Australian Flax Growers' Association Executive decided that in this State the competition should be divided into four mill districts or zones.

The winner in each zone competed for the Championship crop.

Prizes of £10 will be awarded for the Winning Crop in each zone and an additional £10 for the Championship crop in this State.

The winners of the Competition in each zone were:—

Zone 1, Yarloop—Mr. R. T. Newman, Coolup.

Zone 2, Beelerup—Mr. W. Bailey, Balingup.

Zone 3, Boyup Brook—Mr. E. C. Doust, Bridgetown.

Zone 4, Muradup—Mr. J. Ness, Qualeup.

The winner of the *Championship Crop* was *Mr. J. Ness, Qualeup.*

Mr. J. Ness is to be congratulated on his winning entry and there was no hesitation in awarding the Championship to this crop, which reminded one of good crops in previous years, being golden sappy straw 34in. in length at time of valuation, which was four days after completion of harvesting.

The crop was sown with a drill and covering harrows on the 27th May, 180 lb. of super and 72 lb. of seed being applied per acre.

The land was an old pasture field, the subterranean clover having "run out" a few years prior to fallowing. The soil was a heavy red clayey loam, originally timbered with blackboys and white gums.

The field was fallowed and worked in the spring and cultivated prior to sowing in the Autumn with tandem disc and harrows. The ground was still a little cloddy at time of seeding.

Sowing Flax seed in the Boyup Brook area.

Crop of Flax in flower, Yarloop District.

The crop was free of noxious weeds and only a little silver grass and cape weed grew during the season. Harvesting was carried out in a workman-like fashion but the bands were slightly loose and the sheaves could have been better butted. Straw quality was very good but not good enough for full points.

Unfortunately, caterpillars attacked the bolls and reduced the seed content by about 70 per cent. but fortunately no damage occurred on the straw. The seed present was mature and of high quality. The following gives brief details of the winning crops in the other zones:—

Mr. R. T. Newman, Coolup.

A field of 12 acres which was sown on sandy surface land with a heavy clayey subsoil originally carrying subterranean clover pasture. The timber prior to clearing was red gum with blackboys and odd jarrah.

Harvesting Liral Crown Flax crop at Muradup.

Flax in stooks ready for carting to mill.

The seed and super were broadcasted on with a super spreader at the end of May after the land had been worked down with cultivators and harrows. After sowing light harrowing followed. The rate of sowing was 72 lb. seed and 2 cwt. super per acre.

Early germination was excellent but some thinning out occurred from red mite.

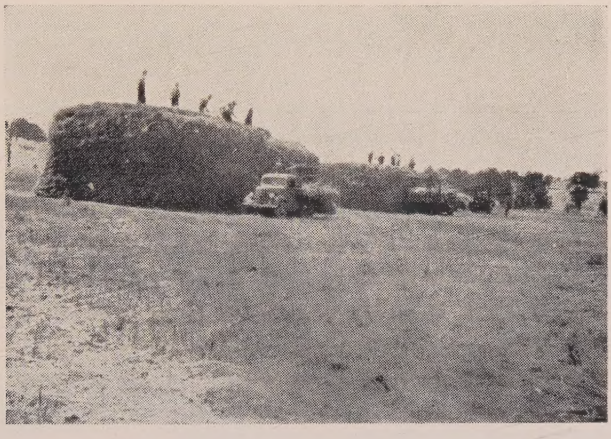
The crop did not finish evenly being much taller at one end than the other end but as a general average was about three feet high.

The main weed was silver grass and sedge in the wetter spots. Harvesting was fair. The straw had slight rust damage and about 60 per cent. of the seed was lost from cutworm damage. Fortunately, very little damage was done to the straw. Straw quality was standard being uneven and in some parts coarse.

Mr. W. Bailey, Balingup.

An area of 20 acres sown on land which the previous year grew an excellent crop of oats. The land is a medium sandy loam well drained. Prior to planting, the ground was well ploughed and cultivated but owing to wet conditions complete harrowing was impossible.

Sowing was completed on the 15th June and the seed and super were broadcast at the rate of 1¾ cwt. super and 72 lb. seed per acre. The only weeds were oats and some capeweed and a little clover. Caterpillars damaged the straw to some extent and completely deseeded the crop. Rust occurred only on the leaves. Harvesting was completed on the 28th December.



Stacking Flax at the Boyup Brook Flax Mill.

Mr. E. C. Doust, Bridgetown.

This crop was sown on 20th May using 90 lb. seed and 2 cwt. of super per acre. The paddock had been under pasture for the previous three years. After the first rains it was ploughed, disced and harrowed, then sown and harrowed. The harvesting was good and the crop was fairly free of weeds. Straw was strong, medium to coarse; very little damage by cutworms except that the seed was completely taken.

FLAX COMPETITION—1944 SEASON.
Yarloop Area.

Competitor.	District.	Freedom from Weeds.	Length of Straw.	Quality of Straw.	Seed.	Agric. Features.	Harvesting.	Yield.	Total.	Acres Harvested.	Yield per Acre.
Maximum points	....	30	20	20	15	15	20	30	150	Acres.	Cwts.
R. T. Newman	Coolup	23	16	12	6	10	12	14	93	12	28
W. F. Ritchie	Cookernup	20	15	13	4	12	15	12	91	14	23¼
C. Iseppi	Waroona	26	16	12	....	9	15	7	85	20	14
C. Jenkinson	Cookernup	26	12	8	....	12	15	8½	81½	50	17·4
F. B. Trevenen	Cookernup	20	12	10	....	11	15	7½	75½	12	15·9

FLAX COMPETITION—1944 SEASON.

Donnybrook Area.

Competitor.	District.	Freedom from Weeds.	Length of Straw.	Quality of Straw.	Seed.	Agric. Features.	Harvesting.	Yield.	Total.	Acres Harvested.	Yield per Acre.
Maximum points	....	30	20	20	15	15	20	30	150	Acres.	Cwts.
W. Bailey	Balingup	27	13	8	....	11	15	18	93	20	36·0
W. F. Dilley	Donnybrook	29	14	10	....	12	15	10	90	12	20·5
W. J. Pugsley	Lowden	23	12	17	8	8	15	6½	89½	12	12·5
Miss A. Rose	Balingup	27	13	10	....	11	10	16	89	16	32·4
C. F. Matthews	Mummballup	27	13	10	....	12	18	7½	87½	31	14·7
R. J. and F. J. Trigwell	Donnybrook	27	12	9	....	12	15	11	86	26	22·0

Mr. M. C. Gardiner's entry not judged as less than prescribed area harvested.

FLAX COMPETITION—1944 SEASON.

Boyup Brook Area.

Competitor.	District.	Freedom from Weeds.	Length of Straw.	Quality of Straw.	Seed.	Agric. Features.	Harvesting.	Yield.	Total.	Acres Harvested.	Yield per Acre.
Maximum points	....	30	20	20	15	15	20	30	150	Acres.	Cwts.
E. C. Doust	Bridgetown	25	13	8	....	10	16	19	91	21	37·5
C. R. Doust & Son (No. 1)	Boyup Brook	25	11	10	....	12	10	14	82	28½	28·5
C. R. Doust & Son (No. 2)	Boyup Brook	15	7	10	....	11	10	10½	63½	18½	20·7
E. Farleigh	Boyup Brook	17	8	11	....	13	15	10	74	69	19·5
T. S. Hearn	Boyup Brook	20	5	5	....	8	11	10	59	40	20·0

Bailey Bros. area not harvested as below standard.

Brooks & Dent, P. not judged owing to large area not harvested.

C. R. Doust & Son (No. 3) not judged as under standard.

T. Taylor and C. Inglis, not judged as under standard.

FLAX COMPETITION—1944 SEASON.

Muradup Area.

Competitor.	District.	Freedom from Weeds.	Length of Straw.	Quality of Straw.	Seed.	Agric. Features.	Harvesting.	Yield.	Total.	Acres Harvested.	Yield per Acre.
Maximum points	....	30	20	20	15	15	20	30	150	Acres.	Cwts.
J. Ness	Qualeup	28	12	15	6	12	15	10	98	20	20·0
F. J. Hill	Muradup	27	9	5	....	10	12	10½	73½	24	21·0
*H. W. Haggerty	Muradup	16	7	13	....	12	11	11½	70½	67	22·0
*O. Vetterlund & F. Wemm	Muradup	20	5	10	....	10	13	8½	66½	74	17·0
Mrs. E. B. Bumstead	Muradup	15	10	12	....	10	10	7	64	27	14·0
F. Cavanagh & C. Mulvay	Muradup	5	9	5	....	10	17	12	58	30	24·0
*A. Sexton	Muradup	12	7	13	....	8	10	8	57	51	16·0
H. D. Yates	Muradup	15	5	5	....	10	10	8½	53½	28	17·0
H. W. Haggerty	Muradup	....	7	12	....	12	10	7½	48½	16	15·0

* Crop stacked, straw not weighed but estimated.

Agricultural Broadcasts.

The following programme of agricultural talks has been arranged for the April-June quarter and will be broadcast from regional stations at 9.15 p.m. each Thursday:—

Date.	Talk Prepared by :	Title.	Summary.
	I.—FARMERS IN A CHANGING WORLD.		
April 5	A. M. Hutchinson, Public Works Department	Some Aspects of Water Supply	The development of water supplies since earliest times is outlined and the requirements of a good water supply are described.
May 3	R. W. Brownlie, Secretary, Rural Reconstruction Commission	Australia's Countryside	Some impressions of a 40,000 mile tour of Australia.
May 31	C. A. Gardner, Government Botanist	The Origins of cultivated plants	An account will be given of the distribution and origins of the more important cultivated plants.
June 28	C. F. H. Jenkins, Government Entomologist	Camouflage in Nature and War	Insect and other animal colouration will be discussed together with its bearing upon war-time camouflage.
	II.—TOPICAL ITEMS.		
April 12 May 10 June 7	G. K. Baron Hay, Under Secretary for Agriculture, will discuss current events in agriculture.		
	III.—FARMERS' FORUM.		
April 19 May 17 June 14	Discussion on subjects submitted by farmers is arranged by G. A. Currie, Professor of Agriculture, University of Western Australia.		
	IV.—TECHNICAL TALKS.		
April 26	C. F. H. Jenkins, Government Entomologist, Department of Agriculture	Insects in the Vegetable Garden	Some common garden pests and useful control measures will be discussed.
May 24	W. L. McGarry, Sheep and Wool Adviser, Department of Agriculture	Lifting the Clip	Measures for improving the standard of shearing will be discussed.
June 21	G. R. W. Meadly, Assistant Government Botanist, Department of Agriculture	Our Weed Problems—Bathurst Burr	The significance of this weed in Western Australia together with control measures will be discussed.

By Authority: Robert H. Miller, Government Printer, Perth.